### Title
"We will die and become science" : the production of invisibility and public knowledge about Chernobyl radiation effects in Belarus




### Author
Kuchinskaya, Olga



### Publication Date
2007

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA, SAN DIEGO

# “We Will Die and Become Science”: The Production of Invisibility and Public Knowledge about Chernobyl Radiation Effects in Belarus

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy

in

Communication

by

Olga Kuchinskaya

Committee in charge:

Professor Daniel Hallin, Co-Chair
Professor Susan Leigh Star, Co-Chair
Professor Geoffrey Bowker
Professor Valerie Hartouni
Professor Andrew Lakoff
Professor Steven Epstein

2007

The Dissertation of Olga Kuchinskaya is approved, and it is acceptable in quality and form for publication on microfilm:

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
Co-Chair

________________________________________
Co-Chair

University of California, San Diego

2007

DEDICATION

To My Parents and My Brother

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

## ACKNOWLEDGEMENTS

Conducting this research and analysis depended on support from a number of people. I thank everybody who contributed to my inquiries in Belarus: most of the names in this dissertation have been changed, but I am indebted to the people behind the pseudonyms who shared their thoughts and experiences with me.

No less important has been the support, feedback, and own work of my committee members: Daniel Hallin, Susan Leigh Star, Geoffrey Bowker, Andrew Lakoff, Steven Epstein, and Valerie Hartouni. I am particularly grateful to Leigh Star and Geof Bowker for the opportunity to learn so much from them and for all their encouragement; their own research opened some of the most fascinating areas of scholarship for me. Dan Hallin has always been there when most needed; his candid comments helped me better evaluate my own analysis, persist despite occasional frustrations, and not shy away from important questions. Discussions with Andy Lakoff and Steve Epstein revealed the broader perspectives and underlying assumptions of my arguments. Valerie Hartouni offered unwavering encouragement and taught me important lessons on "thinking without banisters."

This project started with perceptive comments from Vince Rafael, who recognized the puzzles behind the topic of Chernobyl consequences, but also my own passion for them. Kim Fortun and Ravi Rajan provided helpful perspectives during particular critical moments of working on this dissertation. Linda Strauss offered generous interest in my work and made me a better teacher.

Discussions with many UCSD friends and colleagues have helped with thinking through different parts of this project and provided more general support in my graduate career.  My thanks to: Cynthia Schairer, Tom Waidzunas, Eric Van Rite, April Huff, Soek-Fang Sim, Ferruh Yilmaz, Sonja Baumer, Toi James, Emma Johnson, Steve Jackson, and Mary Gray.

I am particularly grateful to those whose friendship made my experiences at UCSD so enjoyable. Jericho Burg has been an amazing friend and colleague during all these years; many days were made better with her sense of humor. A two-person writing group with Marie Judson transformed the final stages of working on this dissertation; I thank her for sharing her writing with me and for her thoughtful comments on my work. Former neighbors Adrienne Henning and Joseph Ribaudo came to be 'my people.' This project has benefited from the perspectives of Lucy Tatman, an incredibly beautiful writer and a charismatic speaker, and Kevin Briggman, who inspired with his own dedication to hard work. Thanks to my friends Roman Sokolov, Lyn Headley, Ricardo Guthrie, Nadine Kozak, and Beth Ferholt for being so amazing.

My gratitude also to the staff of the Department of Communication, who have always been very helpful and made everything easier with their good attitude. I particularly thank Gayle Aruta, as well as Judy Wertin, Bea Velasco, Liz Floyd, Jamie Lloyd, Cynthia Svacina, Claudia DaMetz, and Bruce Jones.

I am grateful to Elena Gapova and Serguei Oushakine; their advice helped me during the critical stages of my entering graduate school and transitioning into American academia. The George Soros Foundation and the Open Society Institute provided support at several turning points, including financial support for this dissertation fieldwork.

Finally, there are people my gratitude to whom precedes this work. Many thanks to the 'sociology gang' in Minsk: Ira Skoblya, Nina Zelutkina, Tanya Gaplichnik, Tanya Dashkun, and Tanya Dovger—it is so good that we remained friends despite the distance. Years and decades of friendship with Nataliya L'vovich and Olga Maslovskaya have been a treasure. Most importantly, everything has been made possible with personal examples, love, dedication, and unending support from my parents, Tatiana Kuchinskaya and Gennadi Kuchinsky. This is for you and for my brother, Arseni.

VITA

**EDUCATION**

**Ph.D. in Communication, 2007**
University of California, San Diego

**MA in Gender Studies with Distinction, 1999**
Central European University, Budapest, Hungary

**BA in Social Psychology with Distinction, 1998**
Belarus State University, Minsk, Belarus

**RESEARCH AND TEACHING INTERESTS**

Science and Technology Studies—lay and expert knowledges; technology and the environment; risks and health hazards; science, technology, and human values
Communication—science communication; mass media and science
Gender Studies—gender, science, and technology
Research Methods—qualitative methods of research; grounded theory

ABSTRACT OF THE DISSERTATION

**"We Will Die and Become Science": The Production of Invisibility and Public Knowledge about Chernobyl Radiation Effects in Belarus**

by

Olga Kuchinskaya

Doctor of Philosophy in Communication

University of California, San Diego, 2007

Professor Daniel Hallin, Co-Chair
Professor Susan Leigh Star, Co-Chair

The dissertation examines knowledge production practices following the 1986 Chernobyl nuclear accident and describes the production of invisibility of its consequences: practices that displace radiation and its health effects as an object of public attention and scientific research, and make them unobservable. As a result, links between radiation exposures and their health effects are not constructed, and 'Chernobyl consequences' dissolve into individual health problems of unspecific origins. Processes of the production of in/visibility are analyzed using the example of Belarus, one of the former Soviet Union republics, which was covered with seventy percent of the Chernobyl fallout. The analysis is based on extensive archival and ethnographic research, including analysis of twenty years of media coverage, and national and international scientific publications, field trips into the most contaminated areas, and interviews with experts, government authorities, and members of the affected populations. Building on the analytical traditions in communication studies and science and technology studies, the dissertation contributes to research into systematic production of scientific uncertainty and non-knowledge.

# Chapter 1.

# Introduction:

# In Search of Knowledge about Chernobyl Radiation Effects

> ... [O]n April 26, 1986, the biggest ever man-made disaster ... occurred at a nuclear power plant near the small Ukrainian town of Chernobyl. According to globally acknowledged estimates, Belarus has absorbed most of the radioactive fallout generated by the Chernobyl explosion. As a result of this disaster:
>
> - 23% of Belarus has been contaminated with long-lived radioactive isotopes (4.8% of [the] Ukraine, and 0.5 % of Russia);
> - 2.3 million people have been affected [in Belarus];
> - 135,000 people have been moved to clean areas of Belarus. A total of 415 settlements have been evacuated; [...]
> - Schools ... [and] hospitals and other medical facilities in contaminated areas have been closed. The affected areas have suffered as a result of a huge outflow of skilled personnel.
> - Scientists estimate the total damage by the Chernobyl accident at 235 billion US dollars, which amounts to 32 annual budgets for 1986, the year when the accident occurred.
>
> (*Belarusian State Committee on the Problems of the Consequences of the Chernobyl Catastrophe and United Nations Development Programme Office in Belarus.* 2005 Chernobyl Calendar)

This dissertation explores the *production of invisibility* of the Chernobyl consequences: it describes how Chernobyl radiological and health consequences in Belarus disappear as an object of knowledge. The statistics quoted above—from a calendar produced by the Belarusian government and UNDP to commemorate the accident—describes the economic consequences of Chernobyl in Belarus, but says nothing about the scope of health effects. The numbers of affected or resettled people describe the administrative practices of handling the accident more than they describe radiological consequences.

These omissions are indicative of broader knowledge production processes analyzed in this dissertation.[1]

## Invisibility and Uncertainty from Different Perspectives

In 2003, I discovered online reports and press releases by the United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR 2000) claiming that, in essence, Chernobyl was a myth.[2] In their objective scientific voices, the reports argued that there was no evidence that Chernobyl radiation had significant effects on health in the affected populations. Only one disease was linked to radiation exposure—thyroid cancer in children; the rise in other health problems was blamed on radiophobia (fear of radiation), stress following the collapse of the Soviet Union, and degradation of people's living standards. I had taken it as unquestionable that Chernobyl was a major accident with devastating consequences, and that Belarus, the country where I grew up, was most affected by it. The UNSCEAR reports confronted me with the fact that what I considered *obvious* from my perspective was interpreted as *non-existent* from a different—expert and more powerful—position; their judgment was fortified with claims to objectivity.

I called my family and friends in Belarus and asked them if it was true that Chernobyl had no effects. My family and friends had relatively limited exposure to the Chernobyl consequences, but they were closer to it than I was, living in the United States.

---

[1] The quote in the title of this dissertation comes from Svetlana Alexievich's collection of Chernobyl oral histories (1999), which includes a boy in a hospital counting other children he had known who died. The boy reconstructs their voices. One of them said that, "We will die and become science," while another one thought that, "We will die and be forgotten" (1999, 182).

[2] Based on these reports and press-releases, Polish journalists referred to Chernobyl as "the biggest bluff of the 20th century" (Rotkiewitcz et al. 2001) and American news reported that there is "little to fear but fear itself" (*The Economist*, September 8, 2005).

They assured me that, "Everybody knows there are [sixteen, thirty, or even a hundred] thousand victims." According to them, the accident also resulted in a great rise of health problems in Belarus, consequences which could be verified in numbers. The numbers were "out there," and I was told to "look them up." My other piece of evidence was Svetlana Alexievich's *Voices from Chernobyl* (1999), a collection of oral histories about the experience of the accident, and life after it. However, the book was based on anecdotal data and did not help with the problem of *numbers* or the legitimacy of the evidence.

The discrepancy between the accounts was troubling: tens of thousands dead versus thirty-one victims acknowledged by UN organizations (UNSCEAR 1988, 1996, 2000, 2002; IAEA 2006; WHO 2006; UN Chernobyl Forum 2005). Also troubling was the absence of any conclusive and definitive accounts seventeen to twenty years after the accident. Some basic searches online and browsing through databases of scientific publications showed more press releases and reports from conferences sponsored by international organizations, including the International Atomic Energy Agency (IAEA), but also articles by Belarusian and international scientists with claims about various specific health effects of the Chernobyl radiation. My attempt to 'dive into' the data and compare the evidence was not satisfactory (though it was quite rewarding to learn the relevant science basics); the data and findings were fragmentary, and much seemed to be missing. Trying to make sense of the contradictions, I found myself conducting social ties analysis: noting institutional affiliations of the authors, their references and the kinds of arguments they were making. Connections between UNSCEAR and the international nuclear industry became apparent rather quickly; it was not surprising that nuclear industry experts would be motivated to downplay the perceived consequences of a nuclear accident and maintain or increase the acceptable thresholds for radiation exposures. However, I still did not have an answer to my original question about the 'actual' scope and nature of the health effects.

The more I learned, the more I realized that there were too many variables to keep track of, too many approaches, and too many contradictory arguments put forward by different sources. All of these contradictions and complexities merged for me into something I defined as 'epistemic uncertainty,' an aggregated description of the state of knowledge "out there" with its lack of coherent and uncontested understanding of the Chernobyl effects, which could be determined by the properties of the phenomenon itself (radiation and its effects). At the time, I did not realize that not everybody was uncertain. I *became* 'uncertain' as I was trying to learn more—in the context of controversial science and while remaining in my particular social and institutional position. The people I spoke to in Belarus remained perfectly certain, though admittedly not very knowledgeable with respect to the details of scientific research on Chernobyl. It was difficult to tell what most of the scientists were certain about.

At the time, however, I thought of uncertainty as a property of the situation: the *phenomenon itself* was difficult to construct definite knowledge about. Chernobyl radiation was not available to unaided human perception; it was 'invisible.' There were also no immediate bodily reactions in people and, unless the doses were very high, health effects could be delayed in time and they were not radiation-specific. My logic was simple: people were not marked by radiation in the same way as when they, for example, fall off a bicycle and get bruises. The effects of radiation—the causal connections between exposures and resulting health problems—are not immediately observable. To appreciate the relationship between human senses and production of knowledge, the reader could imagine a source of significant radioactivity in their immediate environment or inside their own body. Impressions provoked by this thought experiment are just that – impressions with no immediate and direct experience of the reality that would verify them one way or another; and they would remain 'just impressions' even if there were an actual source of radiation. This lack of immediate experiential confirmation of either radiation or its effects is a problem, but it is important to understand *why* it is a problem—and how it is linked to the current state of knowledge about radiation effects. What types of knowledge production practices (and *whose* knowledge production practices) become more difficult when radiation is not visible to a *naked eye* or is not leaving immediate *marks on the bodies of affected people*? How are radiation effects made observable and 'knowable' by different groups in the society, including experts and laypeople living in the affected territories?

The ultimate questions of this dissertation are: How has interaction between different perspectives—different groups of laypeople, experts, government leaders, and representatives of international organizations—been shaping the problem that is called "Chernobyl"? How do we know that the knowledge we are producing about environmental hazards is 'adequate,' and what social mechanisms guarantee that? Will we know the scope of the Chernobyl consequences with more certainty, and if so, what kind of knowledge is it going to be? There is often a belief that "time will tell," "the truth will come out," and we will eventually know; I heard this sentiment repeatedly from Belarusian scientists, whose theories and data were being ignored or discredited. Will time tell? Or can radiation danger and radiation-induced effects following a major nuclear accident ultimately be obscured and ignored? As will be discussed below, research in social studies of science demonstrates that there is no strict correspondence between the seriousness of the problem (danger) and the amount of attention it receives publicly, and that an effort can be put into *not* constructing risks (Paine 2002). From estimating the number of already dead to calculating the present and future risks, what knowledge practices or social organizations ensure that we eventually learn 'the full story'?

## The Production of Invisibility

Analysis in this dissertation relies on the following insight: imperceptibility of Chernobyl radiation with human senses means that individuals' experience of it is *always mediated*—with technoscientific equipment, maps and other ways to visualize it, but also with narratives. This dissertation describes *the production of invisibility* of the Chernobyl effects, defined as the practices that limit public visibility of Chernobyl radiation and its health effects by manipulating the ways they are represented or mediated. Limiting public visibility of Chernobyl radiation prevents the construction of links between radiation and its health effects, which can in turn be described as production of non-knowledge. As a result, 'radiation health effects' or 'Chernobyl consequences' dissolve into individual health problems of unspecific origins.

Production of public invisibility of imperceptible hazards could be thought of as a process opposite to social discovery of similarly imperceptible agents—as, for example, social discovery of microbes described by Bruno Latour (1988), where microbes were transformed into socially visible and recognized agents.

The production of invisibility is an interactive, relative process. It is the result of interactions between social perspectives; the hazard is made more or less visible with respect to other perspectives and in the context of their interaction. In/visibility of radiation and its health effects changes with manipulations of the following: publicly perceived temporal and spatial scope of the consequences (where and when are 'Chernobyl consequences'?); how the problem is identified and framed (what is the character of Chernobyl consequences?); and how the problem is made observable in various practices, including lay and expert practices. Answers to these questions—where, when, and what are Chernobyl consequences and how to make them observable?—often involve complex social negotiations, power struggles, and technoscientific work.

My analysis builds on the rich foundation of other studies describing how the social presence of particular phenomena, their significance, and our knowledge about them can be erased or, intentionally or inadvertently, not established. Risk theorists Ulrich Beck (1992, 1995) and Piet Strydom (2002) maintain that production of non-knowledge about modern, often imperceptible risks is as important as production of knowledge about them (see below). Robert Proctor (1995) writes about 'social construction of ignorance' about the causes of cancer. In a classic study, Matthew Cresnon (1979) describes the 'un-politics of air pollution.' Michelle Murphy (2006) provides an insightful description of technoscientific 'regimes of imperceptibility' of low-level chemical hazards. In all of these cases, knowledge is not produced, and significance and public visibility of particular imperceptible hazards are either not established or partially erased. Making socially invisible is not just a matter of imperceptible hazards;

for example, Susan Leigh Star and Geoffrey Bowker (1999) describe how phenomena can be made invisible from perspectives embedded in particular technical infrastructures. In communication studies, Todd Gitlin (1980) describes the 'making and unmaking of the new left' in the media (using the concept of 'framing').

I use these and other studies to create a theoretical foundation for the analysis of complex, multi-layered processes involved in the production of invisibility (more detailed descriptions of these studies will be provided in subsequent chapters). Chernobyl, the largest civil nuclear accident to date, provides an important case for this analysis. Increased levels of radiation are relatively *easy* to detect with proper equipment (unlike many other imperceptible risks) and ionizing radiation is also one of the most studied hazards. Provided this general ease of detection and extent of research efforts, "unknowledge" about radiation health effects, to borrow the expression of the physicist and nuclear critic John Gofman (1990, 2), provides an opportunity to examine conditions and practices that might be reproduced in cases of other less-studied hazards and less dramatic accidents. The analysis in this dissertation will demonstrate a number of layers in the production of invisibility; some of these layers might be unique to the post-Soviet circumstances, but many are likely to be reproduced in other contexts of imperceptible hazards.

The rest of this section provides a brief description of the dialogical approach that this dissertation adopts for the analysis of the production of invisibility.  The following section will consider the relationship between *imperceptibility* of hazards and *lack of certain knowledge* about them.

***

This dissertation provides multiple examples illustrating how hazards are made more or less visible as a result of interactions between social perspectives. My understanding of 'perspectives' is dialogical[3]: there are no perspectives on a particular issue outside of public dialogues. At the same time, perspectives are grounded in particular social positions, and, in that sense, they could be described as situated viewpoints.[4] The theoretical significance of the dialogical approach is that it points not only to the always situated and embodied character of interpretations, but also to the *co-shaping of different perspectives*: perspectives are developed in the course of their interaction and they reflect the history of this interaction. [5]

Perspectives depend on particular local contexts and public dialogues, which are also essentially always 'local': with unique participants, unique ranges of topics and interpretations, and unique histories of interaction. [6] Dialogues are constantly evolving, and new perspectives on 'Chernobyl' continue to appear even two decades after the

---

[3] 'Dialogue,' more than a reference of one perspective (or one text) to another, is a principal form of **co-existance and interaction of** two or more **different** discursive **perspectives** on the same problem (Kuchinsky 1988; Bakhtin 1973, 1981). Bakhtin juxtaposes dialogue to monologue, where there is only one perspective "binding" its audience from the position of authority (e.g., the "authoritative word" of religion, teachers, parents, etc.) (Bakhtin 1981, 342). Bakhtin refers to different perspectives in a dialogue as 'voices' (1973, 1981). A voice always reflects a particular meaningful—or, more precisely, meaning-generating—position; thus understanding of one's perspective allows for a degree of anticipation of what is going to be said. Perspectives on 'Chernobyl' are essentially *social;* as will be discussed in Chapter 6, individuals are aware of more than one perspective and can and do change their own perspectives in different circumstances and personal dialogues.

[4] Since there are at least two perspectives in a dialogue, the same issue or object is presented in a dialogue in at least two different ways: as something and as something else.

[5] According to Gennadi Kuchinsky (1988), each utterance in a dialogue is a response not just to the previous statement, but to the *whole narrative* as it has been jointly co-constructed thus far. If each statement reflects and builds upon *the whole body of the narrative* co-created by both positions thus far, then the two positions are in principle co-shaping each other, yet the unfolding of the dialogue is exactly the outcome of there being two separate, distinct meaningful positions (which neither fully accept, nor reject each other).

[6] Consequently, mass media in different countries have their own dialogues on Chernobyl.

accident. Some older themes can be overshadowed or (temporarily) disappear, while other perspectives can re-emerge again. At the same time, at least in the case of broader public dialogues, even the most radical transformations cannot be assumed to imply that *the whole discourse* changes and transforms into a new discourse; new interpretations do not fully replace, but supplement already existing ones.[7]

## Imperceptible Hazards

This section outlines in greater detail several theoretical questions regarding invisibility and uncertainty in the context of modern technogenic risks. The first issue addressed below is the connection between imperceptibility of modern hazards and lack of definite knowledge about them: why is knowledge about modern hazards often described as uncertain? The question will be explored on the basis of Ulrich Beck's approach to risk studies; my argument will be that uncertainty in the Chernobyl case cannot be viewed as unambiguously accidental or as inherent in the nature of the phenomenon. The second issue is whether imperceptibility of many modern hazards privileges expert knowledges about them and transforms the relationship between expert and lay knowledges, as also suggested by Ulrich Beck. The paradoxical conclusion of the discussion below, however, is that risks do not have to be imperceptible to be 'socially invisible.' I will argue, with Piet Strydom, that the framework of this discussion has to be expanded beyond lay-expert interactions, and that, within the broader framework, one has

---

[7] For example, despite radical transformation of public discourses after the break-down of the Soviet Union, James Wertsch observes that new interpretations of official history in Russia look "more like lists of counter-claims and rebuttals than narratives grounded in new evidence" (2002, 173). New interpretations do not fully replace, but rather supplement already existing ones.

to consider how power relations between different social groups shape when we know and do not know.

## Temporality of Risks and 'Naturalizing' Uncertainty

Estimation of the effects of Chernobyl radiation is a matter of assessing the effects of chronic, so-called low-dose exposure (bracketing the question of whether there were more cases of Acute Radiation Sickness shortly after the accident than were reported by the Soviet government).[8] Chernobyl radiation is different from exposures in Hiroshima and Nagasaki: people have been exposed to it on a daily basis, and the exposures are not only external—radionuclides are also consumed with food products.[9] Overall, Chernobyl radiation is a particular example of modern, technogenic hazards that are not perceptible with unaided senses and that result in delayed health effects (the level of exposure is generally 'lower' than what would produce immediately observable health consequences).

This problem of invisible, 'low-level' exposures to dangerous substances is at the core of social studies of risk; one of the most influential risk theorists, Ulrick Beck, uses nuclear risks as his paradigmatic example of contemporary risks (1992, 1995). The fact that modern risks escape our unaided senses is the starting point for his analysis. He notes that knowledge about these risks is based on causal interpretations, which are

---

[8] The question of how many firefighters and soldiers working to contain the accident and how many laypeople had Acute Radiation Sickness is a question of the Soviet cover-up (see chapter 5).

[9] Exposures resulting from the nuclear bombs in Hiroshima and Nagasaki were instantaneous and the doses were generally higher; people were exposed to neutron and X-ray radiation. Radiation after the Chernobyl accident is mostly alfa, beta and gamma radiation. The major source of contamination shortly after the accident was Iodine-131 (which spread over significant territories in Europe as well; its period of half-life was eight days). The major source of contamination years after the accident is gamma-radiating cesium-137 (the period of half-life is 29 years). The second most spread long-lasting element is Strontium-90. Territories adjacent to the 30-kilometer exclusion zone around the Chernobyl Nuclear Power Plant are also contaminated with Plutonium-234 and Plutonium-235, which decay into an extremely toxic element, Americium.

"particularly *open to social definition and construction*" (Beck 1992, 22-23, emphasis in the original). Establishing these causal connections between exposure to particular substances and specific health issues or illnesses is often problematic. [10] Examples of this have been described in a number of studies in environmental sociology and occupational health,[11] where the cases range from health effects of asbestos exposure to multiple chemical sensitivity (Kroll-Smith and Floyd 1997; Kroll-Smith et al. 2000). At the same time, similar questions related to the difficulty of establishing causal connections appear in the studies of disasters and accidents (e.g. Hoffman and Oliver-Smith 2002; Clarke 1989; Nelkin 1982, 1984, 1992). Part of the challenge in all of these cases is that conditions of research on health effects are not the same as controlled laboratory settings; rather the researchers are faced with the complexity and multiplicity of factors at play 'in the wild.'

Despite the fact that social studies of risk offer a well-developed and insightful approach for studies of these invisible environmental hazards, the concept of 'risk' can also be problematic; in some cases, it might obscure the sources of uncertainty of knowledge about the hazards. Specifically, I am referring to the cases where 'risk' denotes not a possibility of adverse events in the future, but dangers associated with *already existing* chemical and radiation exposures, where people have already been subjected to the hazard and there is already a group that might be identified as victims

---

[10] Phil Brown, Steve Kroll-Smith, and Valerie Gunter (2000, 10) note that uncertainty in these cases is associated with establishing the dose of body's past exposure, dose-effect relationship, synergetic effects, etiology, and precise diagnosis (See also Irwin 1995, 55).

[11] Brown, Kroll-Smith, and Gunter (2000) provide a particular useful summary.

(Winner 1986; Luhmann 1993).[12] In these cases, 'risks' are uncertain, but this is not uncertainty is not a completely unavoidable part of the overall condition, as in cases of *potential* dangers (e.g., in cases where new technologies are introduced before it is established that they are safe) where *potentiality* of negative effects equals uncertainty.[13] For example, in cases of nuclear technologies, a potential event of a nuclear accident can be described as a risk; predicting this risk is a matter of planning for the future.

The *consequences* of the Chernobyl accident, however, constitute a different type of 'risk.' Increased radiation in people's environment and food supply means that something *has been* happening to their bodies. [14] 'Risks' here refer to a chance of developing negative health effects caused by radiation exposure or, more precisely, whether or not the effects caused by radiation will be identified and (considered) significantly negative. Uncertainty of 'risk' (developing negative health effects) cannot be limited to the potentiality of these health effects; it can also be the result of failing to register *already existing* effects (Beck 1992). Thus uncertainty is not an unavoidable or 'natural' condition, as in cases when negative events (e.g., exposures) have not yet happened. The distinction I am making is, of course, an ideal distinction; the argument, however, is that emphasis on the future associated with the concept of 'risks' (Adam 1998) is not entirely applicable here; indeed, it might be 'naturalizing' uncertainty associated with health effects of particular hazards.

---

[12] These affected populations have 'taken the risk,' but rather have been subjected to it, often without their knowledge.

[13] As Helen Nowotny puts it, "the outcome is not known, or knowable, before it has been achieved" (2000, 71). This is captured by the 'semantics of risk' (Nowotny et al. 2001; Ewald 1986).

[14] Beck himself appears to use the term 'risks' rather loosely to mean hazards and the future or potential effects of these hazards.

In social analysis, the term ‘risk’ also masks complex temporal perceptions of danger by various groups and individuals. From technical risk assessment,[15] the term migrated into the studies of psychological perception of risk (e.g. Slovic et al. 1976; Slovic 1985, 1987), which claim that the public is calculating and ‘rank-ordering’ both potential and real risks, the ‘objective value’ of which is amplified or attenuated by various social factors (such as the public’s trust in experts). [16] Via the critique of these studies as blind to cultural and contextual factors underlying perception of different risks (Douglas and Wildavsky1982; Douglas 1986, 1994), the concept has been appropriated in the broader social studies of risk. Within these studies, temporality of risks is not a factor of individual assessments of danger: Have the exposures happened already? How long ago did they happen? Are they happening routinely? Could there be effects already? When can effects be expected? Chapter 6 will argue that different interpretations of the temporality of danger change individual and public perceptions of it. Furthermore, varying expert and administrative definitions of the temporal scope of danger—as well as the spatial scope of hazard and its effects (where is danger?)—point to what Ulrich Beck (1992) describes as the 'revealing' and 'concealing' of imperceptible risks. Changing and often conflicting definitions of the temporal and spatial scope of the Chernobyl problem—an indicator of its changing social visibility—are one of the major themes throughout this dissertation.

---

[15] The term ‘risk’ is used in expert assessments of the situation aiming to reduce uncertainty by means of statistical predictions: the rates of effects are calculated for the whole population and then relative chances are inferred for different subgroups. Methodologically, expert risk assessment as a tool is *indifferent to whether or not the effects have already happened* (they are calculated as if they are in the future); it is not an inherently sensitive method for the production of knowledge about the ‘actual’ effects. Beck (1992) has written extensively about the problematic assumptions and ethical shortcomings (see also chapter 3).

[16] Strydom (2002) describes historical development of the concept of ‘risk’ and risk studies.

Most importantly, uncertainty in public knowledge about effects of exposures to particular imperceptible hazards cannot be assumed as unavoidable (as would be the case if the event of exposures was potential and in the future); the temporality of both exposures and effects can be defined differently; and changing definitions of temporality and spatiality of the hazard and its effects mark the changing social visibility of the hazard.

**Expert and Lay Knowledges about Imperceptible Risks:**

**The Question of Power**

This subsection returns to imperceptibility of radiation and considers its implications for the construction of knowledge from lay and expert positions. Beck emphasizes the role of experts in the production of knowledge about risks, even though risks implicate other groups in society (Beck 1992, 1995). The difficulty here is that, "Modern hazards require the 'sensory organs' of science—theories, experiments, measuring instruments—in order to become visible or interpretable as hazards at all" (Beck 1992, 27). In one way or another, identifying risks depends on using scientific tools such as dosimeters, maps, specialized scientific knowledge, scientific reasoning, etc. According to Beck, laypeople, even when directly exposed to risks, are 'culturally blind' to them; their senses are 'arrested' (i.e., cannot detect exposure to the hazard); and, as a result, laypeople depend on scientific or administrative knowledge. To enter debates about identification and definition of risks ('definitional struggles') requires 'scientized consciousness' (Beck 1992, 27). Furthermore, "so long as risks are not recognized scientifically, they do not exist – at least not legally, medically, technologically, or socially, and they are thus not prevented, treated or compensated for" (Beck 1992, 71). *Ecological Politics in an Age of Risk* (Beck 1995) concludes with the question: "What if radioactivity gave one an itch?" Beck's answer is:

> Nuclear policy, as well as dealing with large-scale modern hazards, would be confronted with a completely changed situation: the subject under dispute, the subject at hand, would fall *within the orbit of cultural experience*. The consequences of progress would not only injure people, but this injury would also be an unpleasant experience engraved on their minds (1995, 184, emphasis added).

Beck seems to indicate that some cultural mechanisms of knowledge production have become impossible: they do not extend to imperceptible risks. Knowledge politics and issues of sociology of knowledge have become particularly salient; what is at stake here is no less than the question of how democratic the resultant practices are:

> This is what will decide the future of democracy: are we dependent on the experts for every detail in issues concerning survival, or does the culturally manufactured perceptibility of hazards restore to us the competence to judge for ourselves? Are the only alternatives now an authoritarian or a critical technocracy? Or is there a way of counter-acting the disempowerment and expropriation of everyday life in hazard civilization? (1995, 184)

The same problem is at the core of Alan Irwin's discussion of expert and lay expertise in *Citizen Science* (1995), though, for Irvin, the question is largely an issue of social action and policy-making rather than knowledge per se. At the same time, a number of researchers (writing about modern technogenic risks, not just exposures to imperceptible hazards) either do not share Beck's diagnosis of the relationship between lay and expert knowledges, or complicate it. Authors highlight that laypeople rely on their own 'hermeneutical' approaches (Lash 2000), or 'popular epistemology' based on individual and community experiences (Brown 2000); other authors stress complex 'populist' structures of incorporating and transmitting lay knowledges within contemporary environmental movements (Couch and Kroll-Smith 2000). The works of these authors draw attention to local knowledges of lay people as one resource for what Beck calls 'the culturally manufactured perceptibility of hazards.'

These important clarifications complicate the question of dependency of laypeople on expert knowledge, but the question ultimately remains about *relationships of power* in regard to practices of knowledge production—as well as production of non-knowledge and unawareness. Brian Wynne's study of farmers living near the Windscale nuclear power plant highlights the social reflexivity of the public, maintaining their 'ignorance' when expert knowledge threatens their identities in the context of institutional dependencies (1992, 1996; see also chapter 7 of this dissertation). Steven Epstein (1996) has described a very different example of social movements pursuing forms of participation in science production (in the case of AIDS research); here, too, the processes of involvement with knowledge are essentially the power relations that shape and change identities of lay experts. By exposing the underlying power dynamic in lay-expert relations, these cases complicate the questions asked in studies of the public understanding of science (how to teach the public to understand the 'language of science') and risk communication (how to effectively communicate scientific information and knowledge about risks to the public) (e.g. Krimsky and Plough 1988). The questions of perfect communication are transformed into deeper questions of interaction between unequal social positions, issues of power, institutional control, and threats to social identities—with the power dynamic potentially complicated by imperceptibility of the hazards with unaided senses.

**Power and Produced Ignorance**

In some aspects, the dynamic of power related to invisible environmental hazards is easy to observe. The literature on risks argues that distribution of modern risks often, though not always, follows class and race lines (Brown et al. 2000). As Beck puts it, “risks accumulate at the bottom” (1992). At the same time, resistance to identifying invisible environmental hazards and mitigating them often comes from economically motivated and potentially responsible industries and businesses, as well as government agencies. Their resistance has been described as 'organizational deceit' (Brown et al. 2000; Nelkin 1992), or 'organized irresponsibility' (Beck 1995; Clarke 1989). Justifications for neglecting to identify and mitigate environmental hazards are often economic in nature, presented in terms of cost-benefit analysis or of actual material needs faced in Third World countries (Beck 1992, 45). Regardless of whether neglecting hazards is ethically justifiable or not, the outcome is often an effort not to construct the risks (Paine 2000) and 'social construction of ignorance' (Proctor 1995).

The international nuclear industry has much to lose if the explosion at the Chernobyl nuclear power plant effected the health of millions of people in different countries, or, in other words, if chronic exposure to relatively small levels of radiation (only slightly higher than levels of natural radiation in some regions) have noticeable health implications. This is a question of future accidents, which might be unavoidable based on the level of complexity of nuclear plants operation (Perrow 1984), exposures of personnel and near-by populations (nuclear plants constantly 'leak' low-levels of radioactivity), as well as medical and military uses of radiation.[17]

Beck himself (1995) specifically addresses Chernobyl consequences—in abstract terms and in the context of Germany, posing the question that is at the heart of the present study: “People are still wondering what happened to the horror, the shock of Chernobyl” (1995, 151). According to Beck, what happens to a person who would attempt to find out the answer can be described by drawing an analogy with Kafka's “The Trial.” In the labyrinth of bureaucratic, organizational irresponsibility, the person's attempts to learn about the consequences of the accident are self-defeating. At the end of Beck's ironic exposé, the person acknowledges his own naive mistake for bringing up such a difficult and complex matter in the first place. According to Beck, “The number of Chernobyl dead will never be counted” (1995, 151).

If we never find out the consequences of the Chernobyl accident, what distinguishes it from other cases when we do know? (If we ever do.) The literature review offered above points at the nature of the phenomenon itself (invisible, with delayed and non-specific effects), and institutional and economic reasons that prevent radiation and its effects from becoming more observable. I argue that these factors together influence the extent of the social invisibility of radiation danger. Somewhat paradoxically, however,

---

[17] The topic of nuclear energy is particularly acute in the present day political circumstances in the world and in the context of American dependency on oil from countries with unstable or ‘non-democratic’ regimes. Despite the damage to its public image after the Chernobyl accident, the nuclear industry is experiencing a revival. In summer of 2006, the British government has embraced nuclear power as the key energy source in the coming decade. *The New York Times* (July 16, 2006) describes the beginning of the ‘Nuclear Renaissance’ in the US; the issue of nuclear power is framed as a solution to the global warming problems. In *The Chronicle of Higher Education*, Kean (2007) considers the rise of nuclear programs in American universities. As of 2007, Belarus does not have nuclear power plants on its territory, but the Belarusian government has been considering possibilities of building own nuclear industry.

the concept of *social visibility* presupposes that hazards do not have to be invisible to be ignored—particularly when they plague socially disadvantaged groups and require large-scale infrastructural solutions. Susan Leigh Star (2006) in a paper on the aftermath of the Katrina disaster, asks, “What does it mean for something to be in plain sight and also invisible?” Similarly, in the Chernobyl case, it is a question of how the marginality of the affected groups—a rather small, Second-going-on-Third World country and its affected populations, who are mostly poor, rural residents—complicates the circumstances of radiation effects.[18] This requires placing the problem of the Chernobyl consequences in a societal context broader than interactions between affected lay groups and expert organizations.

### (Non-)Knowledge as a Result of Interaction between Different Perspectives

A perspective that allows us to place the production of knowledge and ignorance about imperceptible hazards into broader societal contexts is offered by Piet Strydom (2002). Strydom reminds us of the insight shared by theories of risks and the sociology of scientific knowledge (SSK): production of knowledge about risks does not just mirror the objective reality of these hazards. He highlights the social construction of risks with the following questions:

> Why do only a fraction of the large number of serious objective problems ever become recognized and dealt with as problems? Why do some conditions become defined as problems, commanding a great deal of collective attention, whereas other, equally hazardous or harmful ones do not? Why do objective problems that

[18] ‘Invisibility’ of the country itself might be an additional factor; the Chernobyl disaster is typically associated with Ukraine, which inherited the Chernobyl nuclear power.

> were with us already for a considerable period become recognized as environmental hazards only at a particular point in time? (2002, 49) [19]

According to Strydom, however, SSK is often narrowly focused on practices of knowledge production within laboratories. Social construction of risks could be better addressed by a broader "new sociology of knowledge," concerned with the kinds of knowledge produced by different social actors who "possess distinct competencies, power resources and opportunities yet are interdependent" (2002, 146). Strydom thus emphasizes interactions between different knowledge perspectives in the broader society; fundamental for this process is public communication (which replaces 'reflexivity' emphasized in Beck's analysis) and *discursive* processes of generating, shaping and containing knowledge. 'Risk society' becomes 'communications society.'[20] Importantly, one of the keys to understanding structures of knowledge production in 'communications society' is analysis of the production of *non-knowledge and unawareness.*

***

The discussion above relied on bringing together theoretical and methodological approaches to studies of the production of knowledge about imperceptible hazards (risks). The multiplicity of these theoretical and methodological approaches suggests that the production of in/visibility of Chernobyl consequences has to be studied through a combination of theoretical and methodological approaches from several fields. I rely

---

[19] Strydom observes that theories of risk answer these questions in a way similar to insights at the heart of sociology of scientific knowledge (SSK): "what is at stake in environmentalism is less the survival of humankind than the cultural foundations and institutional organization of contemporary society" (2002, 49).

[20] Strydom offers Habermasian understanding of discourse as a 'reflexive form of communication' (Strydom 2002, 110).

especially on methods and insights from communication studies and science and technology studies. Some of the practices of the production of invisibility described in this dissertation are discursive (including, for example, framing), while others are related to political and organizational regimes (secrecy), institutional and organizational practices, and the practices of shaping formal representations of hazards.

The rest of this chapter will provide more of the context on the Chernobyl disaster and its consequences.  The section below introduces paradoxes of mitigating these consequences—the 'double binds' (Fortun 2001) that created the conditions for administrative, technoscientific, and lay practices making Chernobyl consequences unobservable and, by extension, non-existent (more historical context is provided in chapter 2).

## Catastrophe after the Accident

### Consecutive Circles of Consequences

Radiation effects are not the only Chernobyl consequences. Indeed, the accident is typically described not in terms of destructive health effects caused directly by it, but in terms of what has been done after the accident; the statistics quoted at the beginning of this chapter are a typical example. Not just the accident itself, but also mitigation of its consequences is currently referred to as a 'catastrophe' in Belarus; the later included evacuations and resettlements of hundreds of thousands of people, and subsequent destruction of local infrastructures and industries. The 2003 National Report on the Chernobyl Consequences starts with the following statement, which highlights the non-radiological effects:

> Not everybody can imagine the real scope of the tragedy that Belarus has been experiencing in connection ... [with] the explosion of a nuclear reactor at the Chernobyl Nuclear Power Plant in the bordering [the] Ukraine. A significant number of destructive ecological, health, social and economic effects make it impossible to see the consequences of the nuclear accident narrowly from the perspective of radiation safety. One should also keep in mind that the relative weight of the negative consequences was much greater for Belarus than for other affected countries. Subsequently, the Chernobyl consequences in Belarus are more adequately described by such terms as 'catastrophe' and 'national ecological calamity' (Belarus 2003, 4).

Definition of the Chernobyl accident as a national calamity was officially adopted by the Supreme Council of the Belarusian Soviet Socialist Republic in 1989, after three years of isolated measures and obscuring of the extent of the accident's consequences by the Soviet authorities. During the same period, Mikhail Savitsky, a Belarusian artist, explained the interpretation of Chernobyl as a catastrophe by referring to consequences that could not be fixed:

> It appears to me that the word 'accident' does not fit what happened in Chernobyl. Based on its consequences, it's a catastrophe; and in relationship to people's fates, it's a tragedy. An accident can be taken care of [fixed], 'liquidated'. But catastrophe... If it occurs, what has happened is not fixable. Here, all the paths that we've been traveling have intersected with each other, collided together (*Gomel'skaya Pravda*, August 1, 1990).

During that period (1989-1991), Chernobyl was at its most visible in the Belarusian media and official discourse, and in Belarus it was the discourse of tragedy: the direct consequences of the accident could not be fully fixed, and attempting to fix them in the subsequent years produced consecutive circles of other consequences, adding to and transforming the 'original' problem of chronic and pervasive radiological contamination.

The Ukrainian version of the paradoxical circumstances of mitigating the effects of an ongoing disaster is described by Adriana Petryna's study (2002). The section below includes a brief description of Petryna's research, even though the Ukrainian circumstances were different from what Belarus faced at the time (the differences are summarized at the end of the section). In both cases, however, the period of maximal visibility of 'Chernobyl' was followed by a period when this visibility started rapidly decreasing.[21]

**Administrative-Economic Remediation of Chernobyl Consequences in Ukraine and Belarus**

Petryna considers the Ukrainian governmental remediation practices around Chernobyl effects in the period shortly following the collapse of the Soviet Union (most of Petryna's research was conducted during 1992-1994). The focus of the study is on the government administration of the affected populations and on people's engagement with these practices as a matter of 'survival,' in a country that became much poorer with independence and transition to the market economy. Ukraine had “developed a politics of national autonomy through the Chernobyl crisis, devaluing Soviet responses to the disaster as irresponsible” (2002, 2). The new Ukrainian state—which inherited the Chernobyl plant—provided the benefits and compensations to its Chernobyl-affected populations and made efforts to improve Chernobyl safety (in response, it received “further technical assistance, loans, and potential trading partnerships” from Western countries) (2002, 5). During this period, Chernobyl-related benefits and compensations (especially for those who could receive the status of 'disabled as a result of the Chernobyl

[21] Petryna notes that, by 1996, new amendments to Chernobyl laws stopped some resettlements and cut benefits for inhabitants of the lesser contaminated areas (2002, 86).

accident') provided financial support and access to scarce medical resources. Petryna offers a Foucaultian interpretation of this situation where people were claiming state compensations and protection on the basis of their health: "People were converting themselves from Soviet citizens to biological citizens in their driving efforts to maintain a tie with the state and to avoid abandonment" (2002, 85).[22]

Petryna's analysis of the spiraling effects of disaster remediation applies, with some reservations, to the Belarusian context of the early 1990s as well: the economy of Chernobyl benefits and compensations influenced interpretations of the Chernobyl accident and self-identification of the affected populations. However, the Belarusian context was different, as noted by Petryna herself. Chernobyl compensations, though significant in terms of the economic survival of many members of the affected population, were not as extensive as in Ukraine; fittingly, Belarus was lacking visibility to draw Western assistance: it was not as well-known internationally and did not have the nuclear plant itself. At the same time, a higher portion of its territory was heavily contaminated (23% of the overall territory versus 4.8% in Ukraine and 0.5% in Russia) and the greater part of its territory was contaminated with density higher than 40Ci/km$^2$ (see figure 1.1 below). (One can observe Western media coverage on the Chernobyl anniversary on April 26: it is almost invariably dominated by reports about Ukraine).

[22] According to Petryna (2002), Chernobyl remediation processes in Ukraine have themselves created spiraling effects (as described above) and, significantly, contributed to biological uncertainty: the affected populations ('sufferers') strategically employed imprecision of scientific practices and knowledge in making their status claims. Petryna's insight that non-knowledge serves as the basis for deployment of authoritative power (based on the example of the Soviet handling of the immediate Chernobyl aftermath) will be described in more detail in chapter 3. Overall, Petryna underscores the constructed nature of non-knowledge: what is not known is the result of administrative decisions.

It is tempting to treat the transformation of visibility of Chernobyl in Belarus as a cover-up organized by the post-Soviet, authoritarian regime of President Lukashenko, but the analysis in this dissertation will demonstrate processes that are significantly more complex and ambiguous. I also argue generally that an analysis of how the scope of the consequences was being redefined in different periods cannot be done through 'monological' exploration of the role of government or governmental administrative practices; rather, it requires exploring broader dialogical contexts. I will demonstrate that Western democracies are neither completely external to this transformation, nor are they immune to similar 'disappearances of hazards.' The overall context of the production of invisibility of Chernobyl consequences in Belarus, however, is well described by the words of the most outspoken independent nuclear expert in the country: “The problem is the nature of the problem. Any government would not be able to take adequate measures if faced with a situation like this, where the effort required far exceeds the state's capacity.” [23] The following chapters will describe several layers of the production of invisibility. Throughout the analysis, I discuss the extent to which these processes are similar to cases of identifying and mitigating invisible environmental hazards in Western contexts.

[23] In Beck’s analysis, “the new risks create problems that the state governments are neither responsible for, nor are capable of dealing with” (1992, 20). To deal with consequences of large-scale disasters, the governments have to provide large-scale infrastructural solutions, including those for diagnosis, compensation and rehabilitation of the affected populations (Fortun 2001, Petryna 2002). David Marples (2002) in his description of the Soviet response to the Chernobyl accident argues that it is not particular to the Soviet government, but rather specific to the type of the accident where the government is held responsible (he draws parallels with the Three Mile Island accident). Kim Fortun (2001) describes the response of the government of India in the case of the Bhopal accident, where a transnational corporation was at fault, yet the problems were similar.

***

The task of studying interpretations of the consequences of the Chernobyl accident was complicated by the fact that, approaching my initial field work, I remained 'uncertain' about their actual extent. Positioned far from the affected territories and faced with conflicting reports on the extent of the consequences, I was not sure if there was a real problem behind the representations I set out to study. If Chernobyl radiation had no significant consequences, then what was the purpose of talking to lay people about it? Or, if radiation has decreased dramatically compared to the period immediately after the accident, why should people living in the contaminated territories still care about radiation risks, and why would there be any Chernobyl reports in mass media? These circumstances appeared to be somewhat different from other studies of invisible danger. For example, Cresnon (1979), conducting a study of non-decision-making about air pollution, was convinced that pollution was indeed a significant problem and provided numbers to illustrate his claims. Kroll-Smith (1998) and Murphy (2005) in their studies of the controversial multiple chemical sensitivity and sick-building syndrome, could rely on the fact that there were 'bodies in protest' (Kroll-Smith and Floyd 1998), even if chemical causes themselves could not be detected. In the Chernobyl case, there was a large nuclear accident, but the accident was two decades ago. There could have been thousands dead and millions sick, or it could have been more or less a 'myth.' Consequently, I chose to rely on what minimal scientific administrative consensus there was: I bought a map of the current scope of contamination of the country (based on the contamination with Cesium-137); it had enough colored area—about 21% of the whole territory, according to the 2003 projection map—to suggest that the problem was 'still there' (see figure 1.1). It is worth noting that *certainty* here was again related to *visibility*, or at least, knowing what to look at and point at.

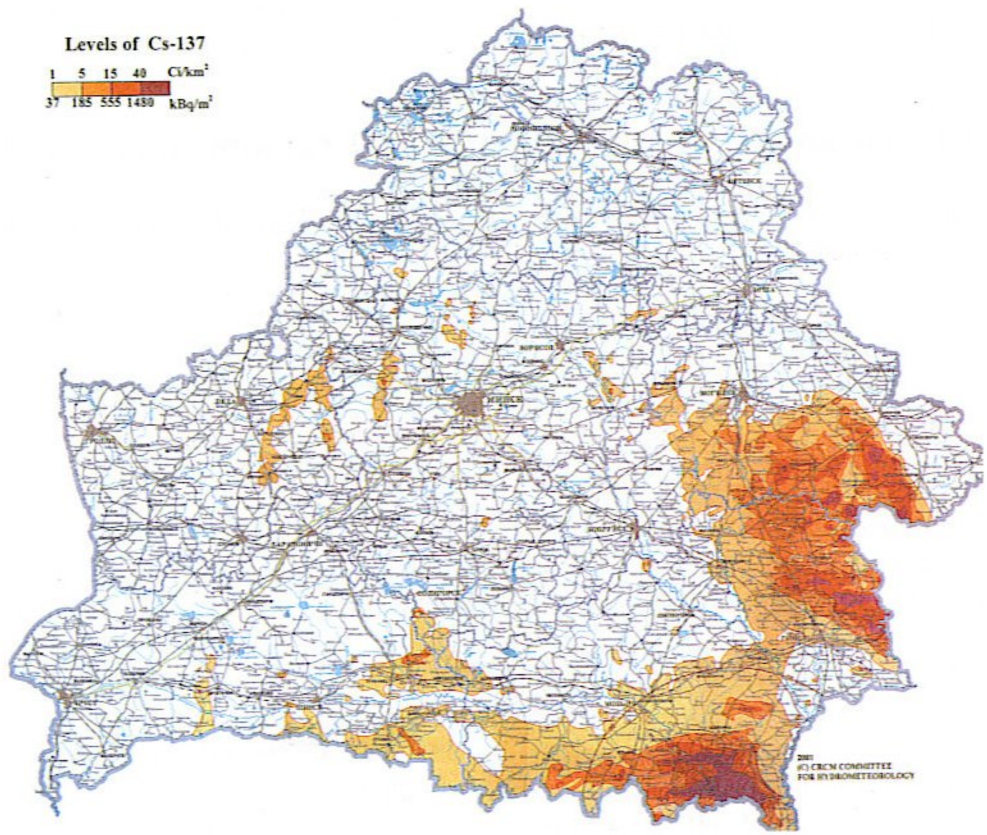


**Figure 1.1** 2001 Map of the Areas of Belarus Contaminated with Cesium-137

Undefined contours of 'Chernobyl' have other implications for conducting research: categories of groups involved change depending on how one defines the problem. These categories are themselves shaped by the same processes and social interactions that have been shaping public understanding of the accident and its consequences. In order to learn the range of perspectives on Chernobyl consequences, I interviewed lay people living on the contaminated territories, as well as Chernobyl ‘experts’—scientists, physicians, government administrators, members of international projects, and members of non-governmental organizations—whose professional activities are related to Chernobyl knowledge production practices. Selection of ‘expert’ interviewees, collection of document sources, and data analysis were guided by the grounded theory methodology (see Appendix. Data and Methodology); ongoing analysis of data allowed for developing theoretical concept early in this research, and the selection of sources was guided by these emergent concepts. As I was conducting interviews and collecting documents, it became apparent that to interpret the current state of knowledge production practices, it was necessary to understand the history of transformation of the public discourse, especially official discourse, on the topic. Systematic analysis of twenty years of media coverage helped reconstruct these transformations by providing a more comprehensive, overarching perspective. Chapter 2 describing these transformations thus provides a historical context for the more specific and localized processes and phenomena described in later chapters. I started data collection in 2005, with the main ethnographic part of research conducted in 2005.

## Chapter-by-Chapter Overview

Among numerous discourses and perspectives on the Chernobyl accident and its consequences, I chose several based on their assumed significance and explored interactions between them ‘vertically,’ with emphasis on their historical transformation, or ‘horizontally,’ with emphasis on their ethnographic variability and specific contexts where they arise. The chapters reflect different methodological approaches: from content analysis of newspapers to qualitative analysis of media coverage, as well as analysis of international reports, scientific publications, data collected during three extended trips into 'the zone' and over seventy interviews with local residents and experts (see also Appendix. Data and Methodology).

**Chapter 2** sets the background for the discussion in the other chapters by considering transformations in public visibility of Chernobyl consequences in the period 1986-2005. Specifically, the chapter considers 'Chernobyl' coverage in the media and describes the production of in/visibility of the Chernobyl consequences by way of redefining the temporal and spatial scope of the accident and the reframing of the nature of the Chernobyl consequences in the official discourse, as well as in local and oppositional media. The official discourse is emphasized as the most coherent and widely circulated interpretation, and is also the interpretation that other perspectives are shaped in relationship to.

Chapters 3-5 discuss expert practices of knowledge production with respect to Chernobyl. **Chapter 3** discusses production of non-knowledge about Chernobyl consequences by international organizations, especially United Nations organizations promoting the development of nuclear industry, strategic references to the needs of the 'affected populations,' and the effects of these international efforts on the politics of the Belarusian state. **Chapter 4** considers, in more detail, how the national research on Chernobyl consequences is affected by external factors, and structural and organizational conditions of the Belarusian research which lead to the invisibility of the "radiation factor" (and consequently radiological effects), as well as invisibility of Chernobyl-related expertise. **Chapter 5** examines how Chernobyl consequences are made more or less visible through adjusting formal representations; the production of invisibility through formal representations is interpreted as a matter of interaction between groups of experts in the context of broader political and structural conditions.

Chapters 6 and 7 discuss invisibility in laypeople's experiences. **Chapter 6** suggests approaches to the analysis of in/visibility from the perspectives of the affected populations, while emphasizing the multiplicity and non-homogeneity of these perspectives. **Chapter 7** continues analysis of in/visibility from the perspectives of the populations who "live with radiation," specifically focusing on how invisible radiation danger is experienced and interpreted on the basis of social interactions associated with it.

**Conclusion** recapitulates the key findings of previous chapters and emphasizes the areas where the production of invisibility is particularly pronounced.

A detailed description of the research sites, methodology and data analysis, as well as some specific methodological challenges encountered during this research, are provided in the methodological appendix.

# Chapter 2.

# Official and Other Perspectives in the Media: Changing Visibility of the Chernobyl Consequences

As discussed in chapter 1, radiation is not perceptible with unaided senses; its visibility and the visibility of its health effects depend on how they are mediated with techniques, tools, and—narratives. One of the main sources of public visibility of radiation in this context is mass media: media coverage brings the hazard up to public attention (Mazur 1987) and sets the context for its interpretation (Gamson and Modigliani 1986). This chapter describes changing media visibility of 'Chernobyl': changing levels of attention to it, transformations of how it is defined in space and time, and changing ways of representing its consequences.

The key role in shaping media visibility of 'Chernobyl' is played by the official discourse on the Chernobyl consequences. The official discourse, the government's perspective in mass media, changes over time and it might not be devoid of contradictions; yet there is a coherency in its presentation and transformations, mainly in that it stems from an identifiable viewpoint.[24] Extensive state control of the media in Belarus makes the official discourse the most developed and comprehensive framework for interpretation of the Chernobyl consequences. As demonstrated by Tulviste and Wertsch (1994) in their study of collective memory in Soviet Estonia, alternative interpretations are constructed in opposition to such coherent and dominating official

[24] 'Perspective' is interpreted here not as a sum total of all the statements, but as a reflection of a meaningful and meaning-generating position. This interpretation is based on the works of Mikhail Bakhtin (1975) and Gennadi Kuchinsky (1988), discussed in chapters 1 and 7.

discourse and thus are necessarily determined by it; this chapter will demonstrate similar effects for oppositional interpretations of the Chernobyl consequences (described at the end of this chapter on the basis of the leading oppositional newspaper in Belarus). The official perspective and the ways in which it makes 'Chernobyl' in/visible are described through analysis of the government-controlled and most widely read newspaper in Belarus (the viewpoint it reflects is consistent with that presented by government-controlled television channels).

The following section describes in more detail this chapter's some theoretical issues regarding how to account for hazard's in/visibility in media coverage. It then outlines changes to visibility of 'Chernobyl' that are described in more detail in the rest of this chapter. Understanding transformations of 'Chernobyl' in the government discourse is essential to understanding perspectives of Belarusian scientists, international experts, and lay residents of the contaminated territories. By outlining the trajectory of these transformations, this chapter establishes the basic timeline, which serves as a reference point for exploration of other perspectives and other dimensions of the production of in/visibility, offered in the rest of the dissertation.

## In/Visibility in the Media

### Indicators of In/Visibility

On a basic level, visibility of an issue in the media can be established through simple quantitative analysis of the volume of coverage on this topic: how often and when it appears in the media. Mazur (1987, 86), for example, discusses the presence and volume of the coverage devoted to indoor radon as a sign that the hazard is an issue on the public agenda. While not sufficient in itself, this quantitative description of the coverage can be highly descriptive—in combination with qualitative analysis of the coverage.

Investigating qualitative characteristics of the coverage commonly relies on framing analysis.[25] Media framing analysis focuses on central ideas that organize information presented in the media and make sense of it for both journalists and reading audiences (Gitlin 1980; Gamson and Modigliani 1989). These central ideas or 'frames' are typically not identified directly but are easily recognizable; they imply a range of positions and associated controversies, and they can be referred to with catch-phrases, metaphors, and recognizable symbols. The power of framing is in how it organizes interpretations. Thus, framing analysis potentially gives access to subtler levels of manipulation of the visibility of the problem; it emphasizes the process through which some aspects of an issue become important and visible while others are left 'outside of the frame.'

Nobody can see everything, and, as will be discussed in this chapter, interpretative frames depend on perspectives represented. The groups that are involved in the discussion define the kinds of in/visibility of the hazard and set the logic of the dominant discourse. In a self-perpetuating manner, the logic of this discourse then affects perspectives by which groups are seen as relevant for the discussion of the

[25] For the early uses of the concept of 'framing' in social analysis, see Bateson (1972) and Goffman (1974). For the use of 'framing' in media analysis, see Gitlin (1980) and Gamson and Modigliani (1989). For the later use of 'framing' in sociology of scientific knowledge, see Eder (1996) and Epstein (1998). Jasanoff (2003) also makes a broader argument regarding applicability of 'framing' analysis in science policy research.

problem and search for solutions. In addition to framing, which this chapter interprets rather narrowly as defining the nature of the problems associated with the hazard, two other features of media discourse are helpful in describing media in/visibility of the hazard.

*Focal issues* is a potentially quantifiable aspect of media coverage which describes what issues are being talked about or looked at when the general topic of 'Chernobyl' is discussed. Different ways of ‘packaging’ these foci (Gamson and Modigliani 1989) can then be interpreted as framing. Focusing predominantly on residents of the contaminated areas (who continue living with increased levels of radiation) versus those who left their homes as a result of evacuations is an example of two different focal issues, but either of these foci can then be framed differently. Attention to different issues (thematic foci) might account for changes in framing and be reflective of power struggles in more dynamic, subtle and complex ways (I do not assume a priori that frames necessarily determine focal issues; the relationship might be more complex than that). [26]

The last (qualitative) characteristic of media discourse that can be used to describe visibility of the hazard is the suggested temporal and spatial scope of the hazard (where and when is the hazard is said to be?). The scope of the hazard is not fixed; identifying changes to it—when these changes happen and how they relate to volume, framing, and focal issues of the coverage—is the ultimate goal of this analysis.

---

[26] As noted above, one issue might be ‘packaged’ or framed in different ways, and, at the same time, different thematic issues might be part of the same frame. Nevertheless, a consistent and systematic shift in what issues dominate the coverage is likely to indicate a change in framing.

The official discourse makes the Chernobyl problem more or less visible in the following ways: it defines the scope and temporality of the problem, and introduces dominant frames (defines the 'nature' of the problem) and focal issues (indicators of the problem). It also defines which social groups acquire a 'standing' or 'voice' in discussions and searches for solutions to the problem. This chapter describes the following transformations of the media coverage of ‘Chernobyl’:

- *Explosion of visibility*. The original response of the Soviet government can be described as an attempt to make the accident and its aftermath as invisible as possible. The chapter discusses radical changes to visibility of Chernobyl three years after the accident: Chernobyl consequences were no longer portrayed as temporary and localized; instead they came to be represented as pervasive, long-term contamination covering at least a quarter of the country. This transformation of the problem corresponded to greatly expanded media coverage and public discussion.[27]
- Visibility of 'Chernobyl' greatly decreased with *economic reframing of 'Chernobyl'* in the mid-1990s. Reframing and subsequent emphasis on rehabilitation and normalization of life on the affected territories further elevated the role of the government and international organizations as experts on Chernobyl problems. Scientists, who were instrumental to the eruption of

[27] Belarusian authors Matyushko and Tsalko (1997) and a Canadian historian David Marples (1996) describe similar three stages: the stage of initial Soviet secrecy and denial of the true scope of the consequences of the accident; the stage of appealing for the international assistance; and the subsequent disappointment in the lack of assistance and “nobody will help us” attitude of the local and state authorities. The later stage will be discussed as part of socio-economic reframing.

Chernobyl visibility in the late Soviet period, played only a marginal role in the later media discussion of the accident and its consequences.

- Government policies of rehabilitation and normalization are met with particular discursive strategies by the opposition: the chapter concludes with the discussion of *hypervisibility* of the Chernobyl consequences in the oppositional press, and of the relationship between these hyperbolic, symbolically overloaded texts to perspectives represented in the official media.

What this chapter describes is summarized in the quote from an interviewee (young professional woman) living in Minsk: “Chernobyl consequences have been shrinking for years now; old statements about Chernobyl being ‘an international problem' sound funny now. The affected area in Belarus has shrunk and is roughly equivalent to the size of an airport now.” Chernobyl consequences have been displaced and contained so effectively that another interviewee, also living in Minsk, remarks: “We live in one Belarus, and the Chernobyl contamination is in some other Belarus.”

**Description of the Newspapers**

This chapter is based, predominantly, on the analysis of twenty years of Chernobyl coverage in the daily *Belarus’ Segodnya* (Belarus Today), formerly *Sovetskaya Belorussiaya* (Soviet Belorussiaya), established in 1927.[28] The newspaper continued after the collapse of the Soviet Union, though it had a period of tension with

---

[28] *Sovetskaya Belorussiya* was established as a newspaper under the Central Committee of the Communist Party of the Belorussian SSR, Supreme Council, and the Council of Ministers of the BSSR

the government in 1995 (after Alexandr Lukashenko was elected president in 1994), and then underwent some editorial and stylistic transformations. It is now the leading newspaper in the country and is published (in Russian) by the Administration of the President. I found and analyzed 550 articles related to Chernobyl, published during twenty years period following the accident, 1986-2005. In the case of *SB*, the sampling was exhaustive; for more detail regarding the newspapers, as well as methods and challenges of identifying Chernobyl-related articles and sampling procedures used, see Appendix *Data and Methodology*.

Chernobyl coverage in *SB* is compared (triangulated) with coverage in a local—also government-controlled—newspaper, *Gomelskaya Pravda*, the leading newspaper of Gomel Region, which contains most of the heavily contaminated territories. For additional sources, this chapter also relies on descriptions of the coverage in two other newspapers. *Ekologicheski Vestnik* (The Ecological Bulletin) started in 1990 as a monthly supplement to *Gomelskaya Pravda* and became an independent newspaper in 1993 with the State Committee on the Problems of the Consequences of the Chernobyl Nuclear Accident (Comchernobyl) as one of its co-founders. Politically oppositional perspectives on ‘Chernobyl’ come from the most prominent independent newspaper in Belarus, *Narodnaya Volya* (People’s Will), which was established in 1995 by Iosif Seredich.

**Table 2.1** Sampled Articles on the Chernobyl Accident and Its Consequences

| Periods: | *Sovetsksaya Belorussiya* | *Gomelskaya Pravda* (years sampled) | *Ekologicheski Vestnik* (years sampled) | *Narodnaya Volya* (years sampled) |
|---|---|---|---|---|
| 1986-1988 | 81 | 46 (1986, 1988) | - | - |
| 1989-1991 | 206 | 74 (1990) | 50 (1990) | - |
| 1992-1994 | 61 | 54 (1992, 1994) | 117 (1993, 1994) | - |
| 1995-1997 | 100 | 88 (1996) | 34 (1996) | 9 (1995, 1996) |
| 1998-2000 | 40 | 34 (1998, 2000) | 25 (1998, 2000) | 30 (1998, 2000) |
| 2001-2005 | 62 | 53 (2002, 2004) | - | 15 (2002, 2004) |
| Total per newspaper | 550 | 349 | 226 | 54 |
| Total | 1179 | | | |

**Description of the Coverage**

Chernobyl coverage in all the newspapers described above has a somewhat cyclical character: it is dominated by the month of the anniversary (April) and ‘round’ anniversary years: 5-year anniversary (1991), 10-year anniversary (1996), and 15-year anniversary (2001).

In *Sovetskaya Belorussiaya*, the first peak of coverage, 1989-1991, was motivated by the qualitative change in Chernobyl discourse in the last years of the Soviet Union, which I describe in detail later. Overall, the number of Chernobyl-related articles in *SB*, as well as their average size, has been declining over the years (see figure 2.1; see also

Appendix *Data Tables*). Gradually, the coverage also becomes dominated by the anniversary date;[29] Chernobyl becomes "what we talk about in April" (28 Apr 1998).

During the peak years of visibility (see the qualitative analysis of the coverage below), *SB* published full transcripts of Sessions of the Supreme Council of the BSSR—up to 4 small-print spreads (eight pages) devoted solely to the transcripts! Overall, however, only four years in *SB* have coverage of more than 25 articles: the year of the accident, the year of the 10th anniversary of the accident, and two years when Chernobyl-related legislation was being discussed, 1990 and 1991.

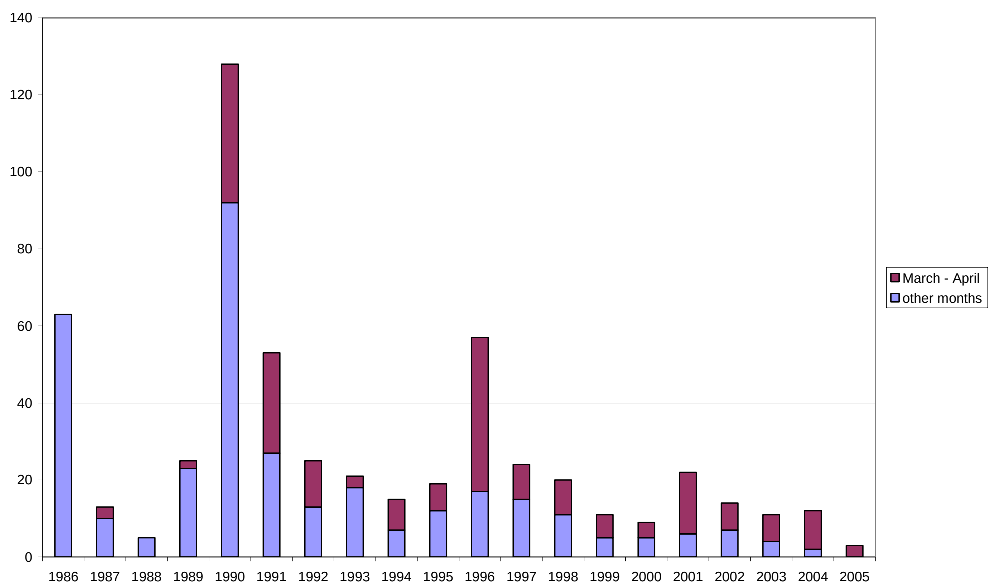


**Figure 2.1** Articles about the Chernobyl Accident and Its Consequences (including articles published in March-April versus other months), *Sovetskaya Belorussiya* 1986-2005

As discussed below, the local newspaper, *Gomelskaya Pravda*, places more emphasis on remembrance of the accident, and its Chernobyl coverage peaks in the 10-

---

[29] Though Chernobyl anniversary is on April 26, in some years, the 'anniversary' coverage started as early as March (as, for example, it did in 1996).

year anniversary of Chernobyl. For the whole month of April, the newspaper published full spreads of articles under the rubric "Ten Chernobyl Years"—each week from a different contaminated district within Gomel Region (see figure 2.2). Even though the *GP* sample included only six months from each sampled year, the number of Chernobyl-related stories for these years is greater than in *SB*.

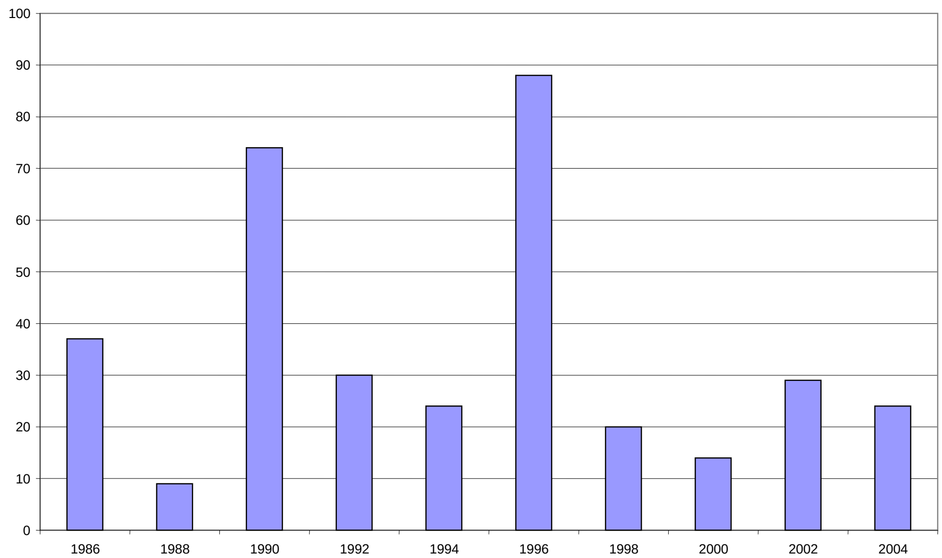


**Figure 2.2** Articles about the Chernobyl Accident and Its Consequences, *Gomelskaya Pravda* 1986-2004

For the description of the positions represented in *SB* and *GP* coverage, see Appendix *Data Tables*. I do not include detailed quantitative descriptions of the other two newspapers because their Chernobyl coverage was significantly more limited, and because of the more fragmentary nature of their coverage (described in the sections below). I now turn to qualitative description of the Chernobyl coverage, focusing on production of in/visibility of the Chernobyl accident and its consequences in *Sovetskaya Belorussiaya* (*SB*), followed by brief comparisons of this national coverage with official coverage in the local newspapers *Gomelskaya Pravda* (*GP*) and *Ekologicheski Vestnik (EV)*. In the last section of this chapter, production of in/visibility in the official media is juxtaposed with features of coverage unique to the oppositional media and specifically *Narodnaya Volya* (*NV*).

## From Invisibility and Secrecy to Explosion of Visibility

### Secrecy and Containing the Accident (1986-1988)

Mikhail Gorbachev, then newly elected General Secretary of the Communist Party, launched the program of perestroika in April 1985. The accident at the Chernobyl Nuclear Power Plant started on April 26, 1986; fires and explosions lasted for ten days. As a test of the Soviet government's policy of 'perestroika' and 'openness' (*glastnost'*), the Chernobyl response was a complete failure (Schmidt 2003). This section summarizes some of the features of the coverage, without reproducing numerous accounts of the Soviet response to the accident (e.g. Medvedev 1992; Read 1993; Marples 1996a; Alexievich 1999; Petryna 2002). For the background information, it suffices to say that evacuations of the residents of the Belarusian part of the 30-km zone around the Chernobyl Nuclear Power Plant and deactivation of the adjacent territories started on May 2, 1986 (Belarus 2001); 24,700 people were evacuated that year.[30] Children from a number of locations were sent to summer camps, often in other parts of the Soviet Union.

The Belarusian response to the accident was coordinated from Moscow, and, as noted by Marples, "the full impact of the accident on Belarus was largely unknown

[30] In total, 135,000 people were relocated and 485 villages were subjected to resettlements (282 - compulsory resettlement) during the years following the accident; 70 of these villages were buried in the ground (Belarus 2001).

outside official circles in the Russian capital" (1996, 38). Secrecy and ideological control by the Communist Party remained pervasive; all the means—linguistic, political, ideological—in *Sovetskaya Belorussiaya's* early coverage of the accident were directed at containing the perceived scope of the accident, in both space and time. The Soviet authorities and the media were referring to "liquidation of the accident," which suggested that the accident was going to be fixed up and eliminated in its entirety (the clean-up workers, mostly military, were referred to as "liquidators"). The early coverage did not mention radioactive fallout on most of the country at the time; rather articles appeared under the rubric *The Zone of Special Attention*, which made the problem appear localized and contained within, first, the zone of 10 kilometers around the Chernobyl plant, and then 30 kilometers. The area was described as the "zone of *temporary* evacuation" and it was "*temporarily* closed." In 1987, some Soviet authorities in *SB* stated that the catastrophe "had been prevented" (July 3), though other cautionary voices suggested that, even though there was no danger, "it is better to be safe than sorry" (April 26).[31]

Later, the focus expanded somewhat from "liquidation of the accident" to "liquidation of the consequences of the accident," thus admitting that there were consequences to be dealt with (Below, I translate the same phrase as "elimination of the consequences" to avoid English language connotations of the word 'liquidation'). The territories immediately adjacent to the Chernobyl NPP were juxtaposed with the rest of the country, which, it was suggested (by omission) were 'clean.'

[31] In 1986-87, a number of articles were devoted to past and present nuclear accidents in other countries, suggesting that in other countries nuclear accidents were 'normal' and that they were frequently not reported in time, thus rebutting foreign criticisms of the Soviet secrecy in relation to the Chernobyl accident and offering Soviet counter-propaganda.

In addition to this discursive containment, there was also blatant negation of any danger. In press, viewpoints of the Soviet and international experts were fused with the position of the Soviet party leadership. Several articles immediately following the accident, and a few later, were based on interviews with top Soviet and international scientists or on reports from their press conferences in May 1986. These top scientists included Leonid Ilyin, director of the Institute of Biophysics of the Academy of Sciences, USSR, Hans Blix, Director General of the International Atomic Energy Agency, and Robert Gale, American leukemia expert from the UCLA School of Medicine, who flew to Moscow to treat the first liquidators who received lethal radiation doses.[32] According to these and other experts whose opinions appeared in the press at the time, the levels of radiation were not dangerous and were improving.[33] In late 1986 and 1987, top scientists appeared in the articles defending the continuing importance of nuclear power. Only two articles featured scientists who were not recognizably part of the Soviet scientific establishment or international experts supporting the position of that establishment; and only one article used a Belarusian scientist as its source. *Sovetskaya Belorussiaya* journalists continued echoing scientists' claims that there was no danger because the doses were low, as late as 1989.

The local newspaper, *Gomelskaya Pravda*, offered similar coverage of the accident, contained under the rubric "The Zone of Special Attention" (*Zona asablivyh klopatay*). Articles about Chernobyl but not mentioning radiation were spread all over the newspaper and tended to have non-descript titles. There were practically no articles

---

[32] The experts offered reports describing what was happening at the site of the accident and what were the immediate consequences of the accident, including the fate of the first Chernobyl clean-up workers.

[33] See Petryna (2002) for the discussion of opinions of the most prominent Soviet and American experts in the post-Chernobyl circumstances.

about Chernobyl in the summer, except a few articles portraying evacuations from the 'zone' in a positive light (people were welcome in new places) or describing children's 'happy vacations' (children from some areas were evacuated to summer camps). Seasonal agricultural issues were business-as-usual. As in *SB*, scientists used as sources corroborated the overall secrecy and denial. Later, an extensive 1988 article suggested that the scientists were studying the consequences: not a single person had a confirmed case of a disease related to radiation exposure—the main problem was radiophobia (June 11).

**Eruption of Visibility (1989-1991)**

Eruption of Chernobyl visibility was intertwined with other political phenomena of the period: greater political openness, stark economic deficit "of almost anything, practically down to bus tickets" (*SB*, 13 July 1990), emergence of identifiable political opposition,[34] declaration of Sovereignty (July 27, 1990), declaration of Independence (August 25, 1991), and the eventual dissolution of the Soviet Union in December of 1991. Notably, the peak in the Chernobyl coverage happened *before* the collapse of the USSR. The media coverage intensified in the context of the Sessions of the Supreme Council of the Republic discussing the Program of mitigating Chernobyl consequences (1989) and laws on Chernobyl-related social protection (1990). In the first half a year in

[34] The nationalist movement—the main force towards independence in other Soviet Republics—was much weaker in the Byelorussian SSR than in, for example, the Baltic Republics or in Ukraine (the issue of the revival of the Belarusian language was, however, rather prominent during this period). The Belarusian National Front was established in June 24-25, 1989, but even before its official establishment oppositional figures (mostly urban intelligencia) were the key force behind both declassification of the Chernobyl documents (in 1989) and raising Chernobyl issues publicly (for more discussion of the events of the period, including their relationship to Chernobyl, see Zaprudnik 1992; Marples 1996).

1990, SB published more articles on Chernobyl than it did in the three and a half years before that (100 versus 81). Belarusian scientists and oppositional intelligencia played a particularly notable role in the 1989 break-through of the coverage.

A dramatic, though not immediate, shift in coverage followed the 1989 resolution of the Central Committee of the Communist Party of the BSSR and the Council of Ministers of the BSSR to develop the 5-year Program of the Elimination of the Consequences of the Chernobyl Accident. That top-down decision to consolidate the effort at mitigating Chernobyl consequences (which previously relied on numerous isolated decrees) allowed for a discursive shift that, given the political climate of the last years of the Soviet Union, grew into a rupture. The very nature of the task changed the temporal perspective: Chernobyl consequences could be and had to be approached not as a *temporary*, but as a *long-term problem*. With greater 'openness' and declassification of Chernobyl-related documents in 1989, publicly recognized spatial scope of the contamination was transformed as well and now included almost a quarter of the Republic's territory.

The 5-year Program of Liquidation of the Consequences was first discussed in *SB* by government authorities, but in the late winter and spring of 1989 scientists appeared as the key source in the discussions. What measures were needed to mitigate the consequences of the accident—potentially including additional mass resettlements from the contaminated areas—was to be based on a scientific concept of radiation protection specifying additional doses of radiation exposure (i.e., doses in excess of natural radiation exposure) that could be safe for people. The so-called 'concept of safe living on the contaminated territories' (the '35 rem concept')[35] advocated by the Soviet scientists—headed by Prof. Ilyin—was publicized as the foundation for the Program;  35 rem was the threshold for radiation exposure doses 'per life,' based on 'international standards.' It was argued that Chernobyl doses for most people were under that threshold; additional resettlements were deemed unnecessary. Several interviews with top Soviet scientists and International Atomic Energy Agency (IAEA) experts appeared in *SB* in the first half of 1989, all supporting the concept.  International scientists were presented as an 'objective' source, calming down the fears of local populations; according to one IAEA expert, "Nobody in France has asked for individual dosimeters" (1 July 1989). For these experts, people suffered from 'radiophobia'(fear of radiation), and their fear was not based on objective, scientific information (see chapter 3).

Though the Soviet and IAEA scientists were advocating old answers, the journalists—prompted by the local oppositional intelligencia—took the few question-and-answer sessions with the experts as an opportunity to *ask* new questions: they raised questions about the health effects of radiation, radiation control procedures and, most importantly, the question of additional evacuations (e.g. 9 Feb, 27 Apr, and 30 May 1989). The first maps of the radioactive contamination of the Republic appeared in February 1989 following one of these sessions. *SB* also published more information on the physics of radiation, as well as the scope and nature of contamination.

Media coverage of the concept proposed by the Soviet scientists was in anticipation of the Session of the Supreme Council of the BSSR in the summer of 1989, where the Deputies would soon be discussing 'the Chernobyl Program.' Belarusian

---

[35] '*35 bernaya koncepciya';* 35 rem equals 350 mSv in the SI system units.

scientists appeared in the media shortly before the Session, disagreeing with the concept proposed by the Moscow-based scientists; *SB* justified inclusion of their perspective as showing both sides of the debate (for and against the 35 rem concept), important not only for the general public, but especially for the Deputies. Belarusian scientists argued that any dose was not 'safe' for human health; it was a question of 'acceptable risks, not absolute safety.'[36] The basic principle behind the alternative Belarusian concept was that people could not live where normal activities had to be limited, i.e., where it was not possible to obtain clean food. *SB* presented the perspective of the Belarusian scientists as more sensitive to the actual context of life on the affected territories and taking into account complex radiological and socio-economic conditions in Belarus. That SB journalists could express sympathy with the Belarusian scientists was, on the one hand, a sign of changing nature of coverage and, on the other hand, was clearly facilitated by the fact that the discussion was framed as a 'technical'—thus not explicitly political—discussion among experts.

Detailed discussion of the 'work of the Session' appeared in *SB* at the beginning of August. Transcripts of the 1989 Session of the Supreme Council included speeches by both Belarusian and international experts (such as Hans Blix, Director General of the IAEA). Amid this discussion, some Deputies were calling on scientists to develop coherent and scientifically based answers: where was it safe and where not safe to live, what was safe to eat, how to get rid of radiation? Developing a scientific concept was

[36] Both sides—Belarusian and Soviet, Moscow-based, scientists—sometimes used the terms *risk* and *cost-benefit analysis;* however, it is not clear what either of the sides meant by it.

linked to securing appropriate investments for dealing with the consequences of the accident.

Significantly, the 1989 Session formed the State Committee on the Problems of the Consequences of the Chernobyl Nuclear Accident (Comchernobyl) and gave Chernobyl the status of 'national disaster.' The visibility of 'Chernobyl' exploded in terms of its recognized temporal and spatial scope, and in terms of the number of stories describing the character of contamination and articulating the nature of Chernobyl-related problems. Following the 1989 Session of the Supreme Council of the BSSR, *SB* started regularly publishing maps of contamination and levels of background radiation. By the end of 1989-beginning of 1990, Chernobyl was unambiguously represented as a long-term problem. The following quotes were typical for that period: "radiation is here to stay for decades... eventually the whole contaminated territory will have to be evacuated from: radiation does not add to one's health" (9 Dec 1989), and "90% of those living on the contaminated territories consider evacuation to be the necessary measure for their protection" (18 Jan 1990). Deputies of the Supreme Council of the USSR would later argue that it was not "elimination of the consequences" but only "minimization of the consequences," at best.

There was also more discussion of radiation control procedures and radiation health effects, including the health of children living on the affected territories, 'Children of Chernobyl,'[37] and their 'health recuperation.' Occasional letters from readers asked

[37] The problem of the 'children of Chernobyl' refers to the concept that children are particularly vulnerable in terms of radiation related health effects.

for assistance dealing with Chernobyl-related health problems of family members, typically children.

The Program was published in October 1989; it adopted the views of Belarusian scientists that people should not live where they could not either produce or be supplied with clean food products.  Publication of the Program was accompanied by some discussion about providing accommodation for evacuees from the contaminated regions. Overall, growing visibility of 'Chernobyl' meant not only more attention to radiological and health problems associated with it; it also highlighted local complexity and enormous socio-economic costs of mitigation of Chernobyl consequences.

The 1990 Session of the Supreme Council of the BSSR, focused on adoption of Chernobyl laws, was televised in full, and *SB* published its full transcripts (24 June - 04 July 1990). The Session was struggling with the multitude of local problems in the contaminated regions, and the economic dimensions of the Chernobyl consequences. The debates were particularly acute, for example, around compensations for those laboring and living in the contaminated territories.[38]  At the same time, some Deputies continued referring to a 'lack of coherent scientific concept of safe living on the contaminated territories' (21 Aug 1990); Ilyin's 35 rem concept was described as 'immoral,' and science overall was described as inconsistent in its conclusions. Top officials framed these science-based discussions and the abundance of local concerns with the issue of economic constraints.  The head of Comchernobyl, A.T. Kichkailo, argued that "the scope of the activities [mitigating the consequences of the accident] is completely determined by our material resources."  Along the same lines, the Prime Minister,

[38] On Chernobyl-related compensations in Belarus, see Marples (1996).

Vyacheslav Kebich, claimed that, “elimination of the [Chernobyl] consequences and [transition to] market economy are tied together” (7 July 1990).

The erupted visibility of the staggering scope of Chernobyl contamination led to political protests and strikes in Gomel and Minsk (there may have been others not covered). Unlike the local media, *SB* did not include much coverage of the strike, except for several stories on protests that followed the Session—including a story on the 1991 Chernobyl Strike Committee, Gomel, that marched to Moscow after they “saw how helpless the Supreme Council was” when dealing with the Chernobyl consequences.

Given the staggering scope of Chernobyl contamination and lack of assistance from the Soviet government (see Marples 1996), the issue of resources to deal with the consequences became increasingly salient; attempts were made to raise the funds nationally. *SB* stories described TV marathons dedicated to raising money, and civic foundations raising money for health recuperation for ‘Children of Chernobyl’ (17 Aug, 1990). The common sentiment in the stories seemed to be that, “before there was not enough openness, now there are not enough resources” (31 Jan 1991). Most importantly, starting from 1990, calls for assistance and cooperation in investigating effects of the Chernobyl radiation were directed internationally.

Articles containing calls for Chernobyl-related assistance, as well as some other articles of this period, came with increasingly strong, emotionally charged expressions referring to the accident: *catastrophe, national disaster, tragedy*, *calamity*, as well as ‘*Chernobyl wound’* and *‘our sorrow.’* Paradoxically, only few articles had used epithets for the accident in 1986, and practically none did in 1987-1989; the rise of epithet use happened only in 1990, a year after the Chernobyl Program was discussed at the Session of the Supreme Council. Most of the epithets referred to the accident and its aftermath; very few referred to radiation and radiation danger (none of them were used commonly and consistently). Surprisingly few articles referred to *radiation danger* or *risk.*

By 1991, the lack of economic resources was interpreted to mean that the state could not relocate everybody from the most highly contaminated territories (28 Mar 1991). Numerous stories were describing common problems and experiences of living there (i.e., problems of radiation control, socio-economic problems related to evacuations and the production of clean food), and state assistance for these regions. At the same time, there were also claims that the problem was with science, which was not consistent in its conclusions.

Notable, however, was also gradual disappearance of scientists as sources on 'Chernobyl' starting from 1991. In 1990, scientists and physicians still appeared as sources on a wide range of topics, from radiological reports or political commentaries on Chernobyl questions to reports on research by international organizations (see chapter 3), though the peak of scientists' media presence was before and immediately after the 1989-1990 Sessions of the Supreme Council of BSSR discussing the Chernobyl Program and Chernobyl legislature.[39] Overall, scientists used as sources in the period of 1989-1991 tended to have heavy titles, and they figured more as particularly qualified politicians than as scientists discussing specific research questions. Scientific authorities during this period actively introduced political recommendations, lobbied particular state programs,

[39] The overall references to science were not always positive; indeed some claimed that the 35 rem concept "destroyed public trust for science" (17 Sept 1990).

and engaged in shaping political action from the perspective of their national and political affiliations.

**Maximum Visibility in the Local Media and Limitations of Visibility (1990)**

Chernobyl coverage in the main newspaper from the most contaminated region, *Gomelskaya Pravda*, also erupted in 1990. It followed the same patterns and covered many of the same issues as Chernobyl coverage in *SB*; this section notes the two aspects in which the *GP* coverage extended beyond what appeared in *SB*: *GP*'s coverage of the Chernobyl-related political tensions, and its radiological coverage. Brief discussion of these areas highlights limitations of Chernobyl visibility even during the period of the most extensive coverage.

Unlike in *SB*, coverage of Chernobyl issues in *GP* included significantly more discussion of the political tensions shaping them. In 1990, *GP* explicitly described the administrative stakes behind Chernobyl decisions. Chernobyl decrees were described in more detail, including articles referring to the Chernobyl discussion as 'socio-political,' sounding alarms that the voices of Belarusian scientists might be silenced, and, most importantly, reporting on political protests and strikes to a greater extent than *SB*. For example, *GP* Chernobyl anniversary reports on April 28, 1990 were followed by nearly a full spread report on Chernobyl-related strikes in Gomel. The resolution of the strike committee, published in full, stated a number of legal, economic, radiological, and health recuperation demands, including calls for the draft of a law protecting the rights of citizens affected by the accident, as well as demands to ban temporary radiation norms and thresholds, and to provide people with individual dosimeters. Characteristically, however, critiques of how the accident was handled, as well as reports from strikes, were often be placed literally next to 'positive,' Soviet-style laudatory articles.

*GP* also published extensive materials on radiation safety, and even letters from readers, checking, for example, for consistencies across reports, or asking how to translate background activity levels into the density of radioactive contamination. In 1990, *GP* also started publishing a monthly supplement, *Ekologicheski Vestnik (EV)*, which literally visualized Chernobyl issues: only two pages long, it was filled with maps and tables describing contamination levels, and stories describing the scope and character of contamination and related problems. Yet careful reading of this supplement tells us about other limitations of the visibility of 'Chernobyl' during that period. Despite the number of local stories published from explicitly critical perspectives (see figure 2.3), these typically did not include references to any overarching, systematic analysis; they were presented as local, 'isolated' cases.

Critical approaches and examination of the 'political' sides of Chernobyl issues also did not expand to questioning of the sources, especially sources of quantitative data. Information on thresholds and norms, including their visual renderings as maps, were provided by government sources; government officials (i.e., heads of related government agencies)—used much more frequently than scientists—appeared as experts replying to questions from readers in QA sessions. The use of these sources came with no discussion of government policies and interests; technical information was provided as 'objective' and never contextualized. This is despite the fact that issues of secrecy and public trust in official sources were raised in other stories published in *Ekologicheski Vestnik* (*EV*), including stories on administrative violations of radiation safety procedures.

ЭКОЛОГИЧЕСКИЙ ВЕСТНИК СЕНТЯБРЬ 1990

# Нужен ли такой каравай?

меня и в агропроме, и руководители хозяйств, занимающиеся уборкой на списанных полях района.

Только рожью засеяно 7.000 гектаров. Согласитесь, весомая «прибавка» к нашему общему караваю...

Родина, как говорится, должна знать своих «героев». Это совхозы «Ветковский» и «Хальч», колхоз «Дружба» Ветковского района, колхоз имени Ленина Буда-Кошелевского и колхоз «Красный Октябрь» Добрушского районов. Деятельность последнего скорее напоминала пиратство. Отряд из четырех мощных «Донов», нескольких самосвалов и передвижной мастерской по ремонту техники во главе с председателем правления колхоза «Красный Октябрь» т. Черкасом двигались по территории соседнего Ветковского района в поисках неубраных полей. И если обнаруживали (рожь, овес — без разницы), тут же набрасывались и... оперативно убирали (на снимке).

Действительно, есть указание Госагропрома республики от 17 июля 1990 года за подписью первого заместителя председателя Е. Ф. Сухорукова. Когда районная санэпидстанция совместно с райагрохимлабораторией проверили зерно на полях, то оказалось, что оно аккурат подходит под новые «ужесточенные нормы».

Непонятно только одно. Коль эти «грязные» земли раньше были списаны из севооборота, а хозяйства расформированы из-за того, что работать и получать хорошую продукцию тут невозможно, то каким образом на этих полях вырастает чистое зерно?

— Столько труда вложено, чтобы вырастить урожай, — не очень убедительно возражал мне главный агроном совхоза «Ветковский» Константин Романович Коновалов, — а теперь оставить неубраным... Это же преступление, нас люди не поймут! Ведь потом хлеб придется покупать в Канаде за золото!

Но разве не преступно кормить «грязным» хлебом людей? Со мной солидарны и эти 90-летние попсуевские старики Яков Мартиянович Некрасов и Кирилл Кириллович Субботин:

— Кому нужен такой хлеб? — недоумевают они. — Кто хотел бы его есть?

Может быть, в Минске, где утверждались «ужесточенные нормы»? Не знаю, как там, а вот в Ветке мне отвечали: «Нет! Не хотели бы!».

Снимок этих стариков был сделан на списанном из севооборота поле бывшего колхоза «Победитель» в деревне Попсуевка Ветковского района. Поле уже убрано, а зерно сдано. Часть его пошла на комбикорм, остальное — для изготовления пищевых продуктов...

— Зерно чистое, — уверяли



**Figure 2.3** "Do We Need This Loaf?," *Ekologicheski Vestnik*, Sept 1990, No. 10
The darkly ironic picture on the right depicts two older men holding a welcoming loaf of bread and a sign, "Vetka District. Cesium-137: 73 Ci/km² + Strontium-90: 1.2 Ci/km²" (Areas with cesium contamination higher than 40 Ci/km² were considered the zone of primary/mandatory resettlement). The article describes local harvesting of these highly contaminated fields, despite the fact that they had been officially excluded from agricultural production. Local authorities, cited in the article, claim that their produce is 'clean.' According to the head of the local farm, "people won't understand" not producing bread here; later "we would have to buy it from Canada with gold."

## Reducing Visibility: Reframing and Normalization

Visibility of the scope of contamination in 1989-91 highlighted the costs of mitigating Chernobyl consequences. Absence of the adequate assistance from the Soviet government, the collapse of the Soviet Union in 1991, and independence further underscored socio-economic issues, including the importance of securing economic assistance for dealing with the consequences of the accident. Indeed, concerns over how the Republic would deal with the consequences of the accident, if left on its own, was one of the arguments for common belief that the Republic should stay within the (now collapsing) Soviet Union: without support from outside of the Republic, there might be no resources for mitigating the consequences.

Socio-economic themes, and calls for both local and international assistance, dominated the coverage after 1991. International organizations and humanitarian agencies appeared as implicit addressees for some of that coverage. The focus was increasingly on the costs of evacuations and on government assistance to the affected regions. Economic concerns were no longer just what radiological dangers were weighed against; rather they came to be the main concern. In the period 1991-1995, Chernobyl was gradually reframed as *an economic catastrophe no less than a nuclear accident or a radiation safety disaster*: it was a catastrophe because of the scope of the effort, lack of finances, and inadequate state of response. With economic reframing of the accident and its consequences, overall public visibility of Chernobyl (all aspects of it) began to decrease. The following section describes the ways in which economic reframing led to 'shrinking' of the visibility of Chernobyl consequences.

The example of *Ekologicheski Vestnik* illustrates increasing invisibility of 'Chernobyl' as an issue of media coverage. In 1993, *EV* became a national newspaper, with Comchernobyl as one of its co-founders. Qualitative changes in the 1993 Chernobyl coverage—topics increasingly socio-economic and administrative, and 'Chernobyl' stories increasingly isolated and anecdotal—preceded later quantitative changes.

Chernobyl-related coverage in *EV* started decreasing from 1993, until it practically disappeared in 2000.[40]

**Turn to Socio-Economic Issues (1992-1994)**

In the period following the collapse of the Soviet Union, the Republic faced growing deficits, inflation, poverty, and joblessness. After adoption of the Chernobyl laws in 1991, the focus of the coverage turned to providing socio-economic assistance and securing funds for the implementation of the Program. In 1992-94, nearly a quarter of all articles were discussing socio-economic assistance from abroad; another major group of articles reported on Chernobyl-related activities of international organizations (see chapter 3). *SB* reported on collecting funds within the country as well (e.g., a major Chernobyl TV marathon was held in April of 1992).

Part of the coverage also dealt with evacuations, as well as socio-economic problems on the contaminated areas and government assistance for them. *SB* reported a cut-back on Chernobyl-related compensations and privileges for the affected populations (such as vouchers for health rehabilitation facilities). At the same time, the newspaper continued publishing occasional letters from readers about children getting sick, asking for help with financing their treatment; references to Chernobyl-related morbidity and ‘children of Chernobyl’ as the most affected group continued to be part of the overall Chernobyl coverage.

[40] In 2000, eight out of ten sampled issues did not have any references to the Chernobyl accident and its consequences.

In this context dominated with concerns about socio-economic issues and calling for assistance, many stories continued using strong epithets and metaphors as, for example, 'nuclear clock of Chernobyl,' 'radioactive tornado,' 'nuclear ashes spread by the nuclear volcano', 'ashes of Chernobyl', 'treacherous radiation', 'our bitter lot', or 'name of the killer: radiation.' The reliance on these strong metaphorical references continued in 1995-97, but the labels of *catastrophe, disaster, tragedy, wound* started referring to events that happened *after* the accident itself, post-Chernobyl decisions and their consequences; they now described the general state of the Chernobyl-related situation.

The boundaries of the 'disaster' were thus being redrawn, but at the same time, paradoxically, the notion of 'Chernobyl' itself had become a recognizable symbol; it was now 'a thing,' something that had an identifiable shape and stood for a commonly recognized set of issues.[41] It could be used, for example, as a symbol of 'hell' or a short-hand reference to an extremely tragic occurrence within articles that were discussing subjects unrelated to the accident or its consequences.[42]

Meanwhile, science and the use of scientists as sources disappeared from Chernobyl-related coverage almost completely; during this period, scientists appeared exclusively in the discussion of the activities and research carried out by international organizations and experts.

---

[41] In Svetlana Alexievich's collection of oral histories, the section "Interview by the Author with Herself about Missing History" begins with observing this transformation of 'Chernobyl' into a symbol and thing of the past: "More than ten years have passed. Chernobyl has become a metaphor, a symbol. Even history." (1999, 19).

[42] For example, an article titled "Alcoholism Is Worth than Chernobyl" describes evils of alcohol-dependency.

**Turn to Normalization (1995-1997)**

The first (and, to date, the only) Belarusian president, Alexandr Lukashenko, was elected in July 1994. Lukashenko began the process of steadily consolidating power, and in November 1996, he held a national referendum, which expanded presidential powers.[43] During this period, the coverage continued to have mostly an economic focus or, more precisely, economic-administrative focus.

Socio-economic problems in the contaminated territories--and *not those related to relocations*—were now the most frequent topic of the articles. Discussing state assistance to the affected areas, the articles noted that the economy of the 'zone' was tied up with the economy of the state, and more articles were now referring to the overall *price of the Chernobyl accident*, as well as the lack of material resources to solve Chernobyl-related problems. The calls for international assistance continued, but many authors were no longer hopeful: "the international society is not going to help us." Ironically, these statements appeared alongside other statements like: "Chernobyl is not just a Belarusian problem" and "We should fight it in collaboration with the whole world." Reports on activities and research by international organizations continued to hold a prominent place in the overall Chernobyl coverage, while the Belarusian president Alexandr Lukashenko publicly stated that Belarus did not agree with the IAEA estimation of the effects of the accident, which claimed that there was no radiation-related morbidity in Belarus or any other effected country (5 July 1995).

[43] The president Alexandr Lukashenko also began counting his time in the office starting from 1996, thus adding two years. Later, 2004 national referendum removed the constitutional term limits for presidency.

In another subtle, yet significant, shift in the nature of 'Chernobyl' coverage and visibility, *SB* reported that the president would now personally supervise the Chernobyl question; he started visiting the contaminated regions at least once a year, in April. Chernobyl coverage became more concerned with administrative issues: the Chernobyl-related activities of the government, its assistance to the affected populations, and local administrative activities.

Even more important was the shift in Chernobyl policies. Emphasizing the fact that it was not possible to relocate everybody, the government—and *SB* articles—argued that it was important to create normal socio-economic conditions on the contaminated territories. In *SB*, the first stories with this focus appear in 1996, around the time of the Chernobyl 10th anniversary. Individual local authorities argued that scientists miscalculated the "level of survivability of people in the zone" (30 Mar 1996), and that "it is not scary to be sick, one can get better" (13 Mar 1996). More importantly, the stories were describing the contaminated areas in a different way, as the places where people wanted to stay and where they were not necessarily in grave danger: "it is dangerous to live here, but there is no desire to leave," and "those who left, die; those who stayed, live" (April 1996). The president himself declared that, "the approaches are going to change" (13 Sept 1996). The new policies aimed to create normal life conditions for people in rural areas. With the emphasis on the 're-birth of the village,' it was no longer clear to what extent either the stories or the policies they were covering were about the consequences of the Chernobyl accident, even if they referred to highly contaminated areas. There are references to a new conception of living in the contaminated territories (2 Apr 1996) including a revised list of localities considered radioactively contaminated (the status of radioactively contaminated territories implies limitations on the scope of agricultural production, as well as some compensations for the population).

The new concept was adopted without much publicity or public discussion; its adoption cancelled benefits for some affected populations. The *SB* coverage included the voices concerned that radiation danger had not decreased as much as was being indicated; whether or not the levels of contamination were still dangerous or not should be declared on the basis of scientific assessments. Yet scientists still did not have any significant presence in the *SB* coverage. Questions of radiation safety measures and descriptions of the scope and character of contamination still appeared, but to a much smaller extent and from administrative sources.

Following the qualitative changes in the earlier years (including economic reframing in 1992-1994), the visibility of 'Chernobyl' was thus decreasing dramatically: the acknowledged scope of the problem was shrinking; there was less media coverage, and what coverage there was depicted the danger as significantly more tolerable. As discussed below, the oppositional movements reacted to this disappearance of 'Chernobyl,' including by organization of Chernobyl anniversary demonstrations. In attempts to forestall these demonstrations, *SB* called for refraining from political protests on the day of the Chernobyl anniversary.

**Normalization and Rehabilitation (1998-2005)**

Discussion of socio-economic problems of the contaminated territories was now often complimented by administrative focus: what the government was doing to solve them, especially in terms of building infrastructures and facilitating overall revival of the territories. There were fewer highly contaminated places on the map of Belarus.[44] The official sentiment was that people had calmed down and realized that, "nothing irreversible has happened, and that, with some willingness, it is possible to return life to its usual course" (27 Apr 2004). The repeated sentiment was that "life overcame Chernobyl" or "life endures."

The president continued to visit the Chernobyl regions in April each year (people offered the president treats from their own farms and the president accepted the offers). His visits were typically occasions for listing positive developments. The official goal remained to create normal life conditions, as well as to continue radiation safety procedures. The program for semi-abandoned villages, for example, was concerned with resettling people from the villages that could not be revived; new villages were being built in the contaminated regions (19 Apr 2005). Contaminated regions were also given the status of the territory of special economic regulation ('free economic zone'). Occasional stories also represented discerning voices, including local residents who would still like to relocate.

Despite claims that the policies implemented on the contaminated territories had "scientific grounding" (26 Apr 2005), there were no explicit scientific analyses or perspectives represented in *SB,* either directly, as separate stories, or indirectly, as

---

[44] In April 1996, following the adoption of the new concept, *Gomelskaya Pravda* published a list of localities that no longer had the status of affected, as well as the list of localities that retained the status. The changes of status were presented as natural; there was no indication of suspicions of secrecy, ignorance, or miscalculation. More localities lost their status of 'affected' in the later years.

references in interviews with officials.[45] In 1998-2005, thyroid cancers were described as the only health problem related to Chernobyl (two 1998 articles also described thyroid cancers not only as an effect of Chernobyl radiation, but also possibly caused by iodine deficiency common in the Southern regions of Belarus). Radiation health effects thus also came to be narrowly defined; 'thyroid' had become a common reference for Chernobyl problems, to the exclusion of anything else. No articles discussed scientific assessments of the current state of the contamination or current scientific perspectives on the health effects of the Chernobyl radiation. There were also more references to building a nuclear power plant in Belarus.

Visibility of 'Chernobyl' thus continued to decrease. Media coverage had become concentrated almost exclusively around the anniversary date in April (see figure 2.1 above). The character of the discourse changed, as well. Starting from 1998, in addition to stories with administrative focus (whose relationship to the Chernobyl accident was not always obvious), other stories began 'historicizing' the accident: more stories were specifically about the days of the *accident* itself (and not the following remediation measures or dangers); Chernobyl was becoming more of a historic event, something that was not a 'current' problem.' More articles about Chernobyl included descriptions of the overall scope of the accident (i.e., what percentage of the overall territory had been contaminated; the number of people evacuated); the scope of the accident was thus presented as *already defined* and situated *in the past*. Finally, few stories talked about Chernobyl from new perspectives and in connection to socially non-

---

[45] In 1998, one brief but important article by a leading Belarusian scientist in the 'News' section mentioned that the old concept of living in the contaminated territories needed to be edited and supplemented, and that the radiation norms were going to be made more strict.

problematic topics, such as the oldest woman in the world living in the contaminated region, or excursions to the Chernobyl plant organized in Ukraine. These stories were not related to radiation safety, health or economic issues, government actions, or people's lives in the contaminated territories. They were merely human interest topics no aimed at making any new observations or conclusions that would change the common perceptions of the Chernobyl accident and its consequences; 2000-05 articles included, for example, histories of informing people about the levels of contamination in 1986 or accounts of 'cold war' spies in the Chernobyl zone after the accident.[46]

This new discourse was mixed with occasional somewhat exaggerated dramatic references. Occasional stories would mention, for example, young painters from an exhibition devoted to the Chernobyl accident, "many of whom have died already," or, Belarusian clean-up workers with obvious health problems—even in cases when their skin had changed pigmentation—were considered healthy. There were also some isolated stories with older sentiments like, "The Chernobyl disaster is not only real, but, according to scientists, it will continue to remind us of itself for years to come" (18 Sept 1998). The 15-year anniversary of the accident in 2001 was marked with another peak in using strong epithets for the description of the accidents, events following the accident and their consequences, but it subsided almost immediately.

[46] There were also more stories about 'other' topics (not directly related to the common understanding of the consequences of the accident), such as an anniversary of the establishment of a research university that studies Chernobyl and other ecological problems.

**Economic Reframing of the Coverage: Summary and Additional Considerations**

Chernobyl coverage in *Gomelskaya Pravda* underwent changes very similar to that in *SB*: the discourse of normalization—and associated decrease in visibility of 'Chernobyl'—rested on economic reframing of Chernobyl-related problems, shift of the thematic foci to socio-economic and infrastructural challenges of life on the contaminated territories (those who stayed as opposed to those who left), and a particular kind of appropriation of the position of the affected populations: "life endures." These accounts also oversimplified (and employed strategically) perspectives of the affected populations (see chapter 6 and 7).

Unlike in *SB*, Chernobyl coverage in *GP* had a stronger emphasis on remembrance of the accident and 'Chernobyl culture.' In March-April 1996, the newspaper published weekly reports "10 Chernobyl years, *GP* in the affected regions." Reports included numerous ethnography-like descriptions of life in the affected district and summarized facts of the Chernobyl history, consequences of the accident, and their impact on various spheres of life in the local districts. Despite the presence of much critique (including individual voices critiquing implementation of the Chernobyl laws or expressing anxiety regarding the new concept), anniversary reports were filled with typical statements agreeing with the new government approaches: "There is nowhere else we can go from here," or "As long as there are children born in the 'zone,' life goes on."

The presidential annual visits to the contaminated regions at the time of the Chernobyl anniversary—much covered in *GP*—on the one hand, added visibility to the Chernobyl anniversaries, and, on the other hand, emphasized the politics of normalization and socio-economic and administrative framing of the problem. In 1996, during one such visit, the president remarked that, “The state would want to give more assistance, but is itself poor” (19 Apr 1996). In 2004, the president remarked that the earlier decisions to evacuate people had been rushed.

As in *SB*, economic reframing of the accident marginalized the role of science and scientists in *GP* in the early 90s. However, *GP* did pay slightly more attention to covering Chernobyl-related research; it included more reports from scientific conferences and workshops on Chernobyl, thus suggesting more links between radiation and morbidity; it also included perspectives of the scientists who considered the former Soviet 35 rem concept reasonable and evacuations rushed.[47] Normalization also implied greater emphasis on radiation protection (30 June 1998; 25 Apr 2000), though in a paradoxical way: several stories argued that people had become indifferent, whereas the doses would decrease only when people assume responsibility for their own health. Thus, not the state, but individuals came to be held responsible for radiation protection.

***

Extensive discussion of the economic reframing of ‘Chernobyl’ should not suggest that discourse about the consequences of the Chernobyl accident is a matter of ‘either-or’: either radiological focus *or* economic focus. Socio-economic concerns related to the Chernobyl accident have been the key focus of the coverage throughout twenty years after the accident: **91.3%** of all articles one way or another refers to these issues (See table 2.2).

[47] For example, *GP* published several articles by a pro-nuclear scientist A.M. Skryabin and his colleagues in 1992 (25 Apr, 16 July, and 19 Nov) and in 1996 (25 and 26 Apr). Skryabin’s views will be discussed in chapter 6.

**Table 2.2** Topic Categories in the Coverage of the Chernobyl Accident and Its Consequences, *Sovetskaya Belorussiaya* 1986-2005

| *Topic categories* | *Percentage of all articles (n=555)* | *Number of stories referring to the topics in the category* |
|---|---|---|
| 1. socio-economic problems | **91.3%** | 502 |
| 2. radiation safety | 60.5% | 333 |
| 3. the accident | 45.3% | 249 |
| 4. government and political questions | 30.9% | 170 |
| 5. health | 30.0% | 165 |
| 6. other* | 27.3% | 150 |

*See Appendix for the list of topics included in the category ‘other.’

The relationship between radiation safety and socio-economic issues as thematic foci is illustrated in Figure 2.4: despite the fact that much attention has been paid to radiation safety in some periods, government-controlled discourse of the consequences has always been dominated by socio-economic issues. The period of 1989-1991 is a good example. On the one hand, radiation safety questions are particularly important (during this period, Sessions of the Supreme Council and *SB* coverage consider additional evacuations, setting thresholds and norms for additional radiation exposure, and specific radiation safety measures). On the other hand, this discussion raises even more socio-economic questions (such as social protection for the affected populations, assistance and funding for the radiation safety measures, relocations, building new accommodations, securing assistance from abroad). With time, the focus on the socio-economic issues remains, while the number of articles discussing radiation safety concerns becomes notably small.

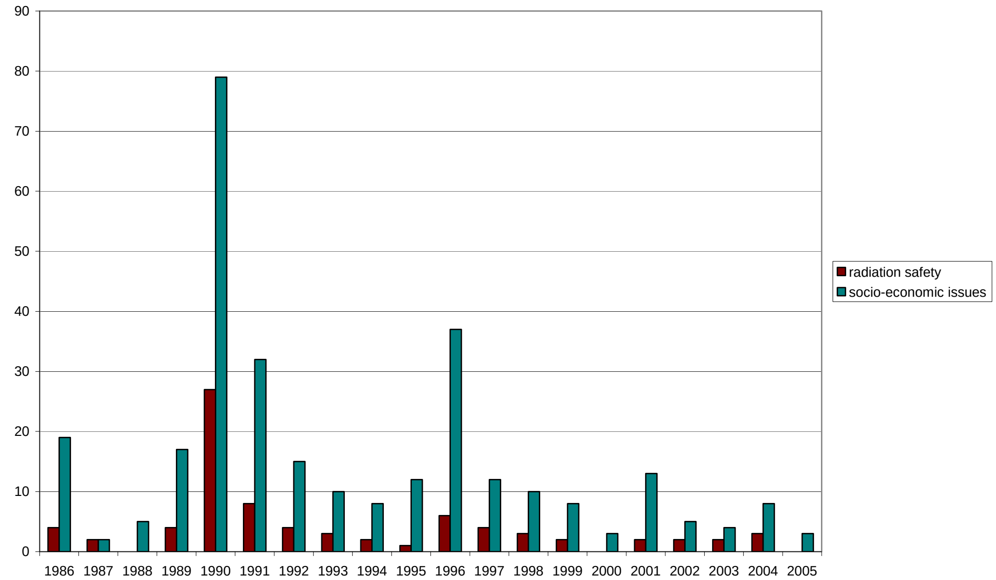


**Figure 2.4** Chernobyl-Related Articles Discussing Radiation Safety Issues and Socio-Economic Issues, *Sovetskaya Belorussiaya*, 1986-2005

Overall, the most common topic in government-controlled Chernobyl discussion is the socio-economic problem in the contaminated territories; the second most frequent is notably the topic of socio-economic assistance from abroad (which, unlike the first topic, only appeared after 1991). Radiation safety measures, radiation-related morbidity, and the issue of when and who has to be evacuated are also among the most commonly discussed topics (See table 2.3). The topic of evacuations is actively discussed during the period 1989-1991.

**Table 2.3** Most Frequent Topics in the Coverage of the Chernobyl Accident and its Consequences, *Sovetskaya Belorussiaya* 1986-2005

| *Topics* |
|---|
| 1. Socio-economic problems on the contaminated territories (n=105) |
| 2. Socio-economic assistance from abroad (n=83) |
| 3. Radiation safety measures (n=81) |
| 4. Government assistance and benefits for the affected populations and regions (n=80) |
| 5. Radiation safety reasons for evacuation (n=77) |
| 6. Actions of the Belarusian government (n=74) |
| 7. Actions of the international organizations and experts (n=62) |
| 8. Radiation-related morbidity (n=58) |
| 9. Descriptions of the scope, character, and peculiarities of the contamination: where is radiation? (n=54) |

## Hypervisibility

This section briefly discusses attempts by the oppositional media to make visible the Chernobyl accident and its consequences, as well as the implications of changes in the official discourse and policies—and the resultant production of *hypervisibility*. The discussion below is not a comprehensive account of the whole Chernobyl coverage in *Narodnaya Volya (NV)* (for example, the section does not address a rather well-covered topic of oppositional objections to building a nuclear power plant in Belarus); the main focus is on hypervisibility as a particular discursive phenomenon.

There has been much less Chernobyl-related coverage in the oppositional media than in the government-controlled media,[48] and, as the analysis of *Narodnaya Volya* shows, it has been much less concerned with socio-economic issues. Rather, the main focus has been on critique of the government ways of handling Chernobyl problems and remembrance of the accident (often focusing on radiation safety and health

[48] This is somewhat ironic since in the last years of the Soviet Union, Chernobyl issues were raised predominantly by oppositional intelligencia and especially the Belarusian National Front. However, *Narodnaya Volya* was only established in 1995.

consequences). Also, unlike in government-controlled media, civic groups enjoyed much better representation in *NV*. Numerous articles in *NV* represented Belarusian intelligencia or individual experts (experts claiming expertise on the basis of their background or education but not speaking as representatives of organizations). At the same time, the coverage included very few laypeople living on the highly contaminated territories.

In 1995 and 1996, when the government media was shifting to economic problems on the contaminated territories as the predominant focus of coverage, *NV* dealt with these issues only indirectly: by criticizing the very turn to economic issues in the official discourse and by suggesting that the government's economic policies had been flawed. It did not publish Chernobyl anniversary reports on April 26, but included reports from Chernobyl Way (*Chernobyl'ski Shlyah*) demonstrations, held in Minsk annually to mark the anniversary of the accident and protest against the government Chernobyl-related policies. In 1998, when the official discourse 'settled into' into socio-economic framing of Chernobyl and the policies of rehabilitation and normalization, *NV* took an even more active role and advertised Chernobyl Way protests, starting several weeks in advance. In April 1998, an article on liquidators (clean-up workers), losing their status and benefits, asked directly: "We want to hear: *Was there an accident, or not*? Were there liquidators, or not? We want *glastnost'* [openness] in this question."

*NV* included articles by individual experts arguing against government policies of repopulation of the contaminated areas, and in favor of more attention to radiation safety, greater consideration of health effects from low-dose radiation exposures, and increased attention health rehabilitation. However, the dominant focus of the coverage was Chernobyl Way protests (discussed below); and perhaps the most significant feature of a number of *NV* articles and its coverage of the protests was the suggestion of the link between political regime, public knowledge, and Chernobyl responses. The suggestion was that secrecy of the political regime allowed the Soviet authorities to lie and misinform the general pubic. The newspaper made parallels to the current political regime in Belarus: this alleged connection between political regimes, secrecy, and the state of knowledge allowed *NV* writers to discuss Chernobyl in the same breath as current political issues, such as, for example, the government crackdown on non-governmental organizations.

At the same time, the oppositional discourse attempting to make 'Chernobyl' visible and to expose the implications behind the state policies had a range of features that together I am identifying as *hypervisibility*: the discourse relied on heavy use of metaphors and highly symbolic images, hyperbolic language, use of uncorroborated numbers to draw attention to the problem (such as numbers of the victims of radiation exposures), and figures of speech that generalize and over-extend Chernobyl as a symbol. The discourse typically extended the temporality and spatiality of Chernobyl contamination and consequences considerably compared to the government discourse, but it was lacking concreteness of either solid empirical data or experience-based descriptions of life in the contaminated areas.[49] I interpret this hypervisibility as, on the one hand, reaction to the disappearance of Chernobyl consequences in the government and broader public discourses and, on the other hand, as representative of the

[49] Lack of solid empirical data describing the scope of Chernobyl consequences is a more general problem, not specific to *NV* (see chapter 4). Approximate, uncorroborated numbers (used as figures of speech: "millions of victims" or "thousands dead") hold the place of—and point to unavailability of—official and commonly-acknowledged numbers needed to describe the scope of the consequences.

perspectives of urban intelligencia, far removed from the contaminated areas. Finally, it points to the lack of inclusion of the perspectives of the affected populations themselves.

Hypervisibility can be illustrated through the following examples. The April 1998 article on "the cost of life" affected by Chernobyl pictured a bald, obviously sick child against the background of the Chernobyl nuclear power plant (see figure 2.5). Images from 2000 Chernobyl Way—captioned "We Are the People"—include a range of symbols, including national flags (not recognized by the state government), the Constitution, "Japanese [paper] cranes" symbolizing cancer victims, an icon of Chernobyl Godmother, and a young person whose face is hidden under a bandana (to protect from identification by authorities) (see figure 2.6).[50] Demonstrators carried a bell "that reminds of the horrible tragedy that happened in April of 1986." The temporality of Chernobyl was notably extended compared to the official discourse: Chernobyl Way had to do with "concern for life of the future generations."

[50] It is not uncommon to see some people covering part of one's face with scarves and bandanas during oppositional protests. Commonly circulated stories in the late 1990s described the government secret service openly taping the demonstrations, even making a point of it.

Горькие раздумья

**Выплаты людям, которых Чернобыль превратил в инвалидов, занижены в 23 раза, а “компенсации” семьям погибших чернобыльцев – в 25 раз. Сегодня цена потерянного в Чернобыле здоровья определена в 100 долларов, а цена жизни чернобыльца – в 150 долларов**

**Figure 2.5** “Payments to people who Chernobyl turned into disabled...,” *Narodnaya Volya*, [27] Apr, 1998.
The title of the article reads: “Payments to people who Chernobyl has turned into disabled are reduced 23 times, and ‘compensations’ for the families of perished Chernobylites [clean-up workers] are reduced 25 times. Today the price of one’s health lost in Chernobyl is set as 100 dollars, and the price of life of a Chernobylite – as 130 dollars.”

Heavy use of symbols was complemented by exaggerated and emotionally-charged language. Demonstrators were described as arguing that: “Time does not muffle, but rather makes more acute, the pain with which Chernobyl burnt every—yes, every!—resident of Belarus.”[51] The resolution on the 14th anniversary of the Chernobyl tragedy—signed by a number of individual scientists, liquidators, oppositional leaders, and

[51] Most of the territory of the country was covered with short-lived radionuclides immediately following the accident (with the exception of the small Northern parts of the Republic); only 23% of the country was covered with long-living radionuclides, including most notably cesium-137, stroncium-90, and plutonium-234.

Belarusian intelligencia—argued that “the nation is on the verge of extinction.” The anniversary coverage in *NV* referred to Chernobyl as “one of the greatest catastrophes of the century” and even “one of the greatest tragedies in the history of humanity.”


**Figure 2.6** “Chernobylski Shlyah 2000. We Are the People!” *Narodnaya Volya*, March-April 2000, preceding April 26 anniversary

Similarly, the 2002 Chernobyl Way coverage referred to Chernobyl as "the Belarusian wound that would not heal" (*nezazhivaushchaya rana Belarusi*) and claimed that, "Chernobyl has touched every resident of Belarus." Another letter signed by twenty-one public figures argued (without providing support for their numbers of victims) that: "During these years, radioactive death [*radyyacyinaya smerc'*] has taken more than 200,000 people; one quarter of the territory of the country is contaminated with long-living radionuclides – it is 1,84 million people, 500, 000 children and adolescents." 2004 Chernobyl Way coverage could serve as an example of over-generalizations: "Black misfortune [*chornaya byada,* a linguistic play on 'Chernobyl'] is felt in the non- contaminated regions as well," and "Ecological Chernobyl, economic Chernobyl, and moral and political Chernobyl are creating deep order crisis [*sistemny crisis*] in today's society, threatening us with new misfortunes."

In this critique (as well as in some articles in *SB* and *GP*), residents of the contaminated territories were often described as 'hostages': "of the peaceful atom," "of the state," "of the regime," "of the tragedy," or, from the perspective of the government media, "of the circumstances."

Chernobyl Way reports and other *NV* articles thus raised a number of significant questions (health recuperation for children, radiation safety thresholds, loss of benefits for the clean-up workers). However, the over-dramatized nature of their discourse betrays the position far removed from the actual contexts of the contaminated territories, and not representing the views of the people who continued living on the contaminated territories (on experience and hypervisibility, see chapter 7). *NV*'s oversight of local experiences is paradoxically antithetical to the local newspapers' lack of generalizing and 'scaling up' from particular local experiences (described above). More generally, however, hypervisibility might be indicative of attempts to call attention to and remember the phenomenon with unclear, even erased, contours; it's a reference to what has not been articulated precisely.

The oppositional perspective regarding Chernobyl consequences was also clearly shaped in response to the government discourse. The following quote from an interviewee living in Minsk highlights this point: "Chernobyl Way appears as something that is not related to radiation, as an attempt of the opposition to remind about themselves... I don't think they have a viewpoint on Chernobyl consequences as such. It is more of 'We got beaten so many years ago, the bruises are gone, but we've been beaten, haven't we?'"

***

To what extent did the conceptual shift in the government discourse matter? Shifts in the discourses of the state government materialized in a multitude of institutional and local administrative practices: relaxing standards of radiation safety measurements, eager changes to the status of the territories (indicating the level of contamination there), and generally, creating circumstances where problems were unlikely to be brought up 'from below.' Even when official thresholds had not been changed, they could 'wither away' in practice. With this conceptual shift, the government and, to some degree, international organizations (as institutions that provide economic assistance to the affected regions) became the main authority on the consequences of the accident, including defining the scope of radiation safety. Invisibility of Chernobyl radiation and its danger in the official discourse was produced through re-defining ‘the catastrophe’ in almost exclusively economic terms, over-generalizing and diffusing images of it, and displacing scientists from their role as public experts.  Particularly notable hypervisibility of ‘Chernobyl’ in the oppositional media around the time of the Chernobyl anniversary, rather than serving as an effective counter-balance to the government-controlled coverage, might have instead reduced credibility of alternative stances and thereby supported the official position.

# Chapter 3.

## In Dialogue with the International Nuclear Community:

## The Importance of Non-Knowledge

Among different perspectives on the scope of Chernobyl consequences, the perspective of the International Atomic Energy Agency has been the most unyielding. In 2007, the Agency—along with other UN organizations such as World Health Organization and United Nations Scientific Committee on the Effects of Atomic Radiation—were insisting that the number of deaths attributable to the accident was fewer than fifty. This chapter analyzes this perspective in its relationship to those of the affected populations, the Belarusian government, and local scientists.

My analysis draws on, and extends, conclusions of Brian Wynne's study of complexity and reductionism in scientific knowledge (2005). Wynne approaches production of scientific knowledge as inherently addressed toward particular audiences, i.e., the public, users, or investors. He describes a paradox in production of scientific knowledge using as his example the field of genomics: the complexity of scientific knowledge is recognized but then "seamlessly bracketed or deleted." To explain these reductionist simplifications, Wynne notes that they are co-constructed with the view of the public as "incapable of living with the provisionality of scientific knowledge" (2005, 94). Excluded are "elements of knowledge or non-knowledge (ignorance) which are assumed... to be troublesome to ... the relationship [of the institutions] with their 'audiences'" (2005, 74). This reductionism does not reflect the actual needs or capacities of the public; rather it is grounded in the regulatory science institutions' own inability to deal with uncertainty, the inability “generated by the assumed aim of predictive control” (2005, 74) and “systematically shaped by a background concern about social control and authority" (2005, 84).

The efforts by the international nuclear experts to establish their authority produce similar "simplification" of the complexity of the post-Chernobyl circumstances and unwillingness to consider the phenomena that cannot be explained by the already established theories.[52] Reducing the complexity of the radiological effects corresponds to the view of the public as incapable of handling uncertain and incomplete knowledge. This expert discourse relies on the exclusion of the actual voices of the affected populations and voices of the local scientists whose attempts to account for the complexities of the situation are discredited as incompetence (chapter 5 will consider the work of "aligning" theories with empirical measurements).

As a discursive tool, the “deficit” model of the public accomplishes more than one task: it also justifies the calls for institutional mechanisms to ensure “authoritative” knowledge about Chernobyl consequences (presented as achieving expert consensus), and it even explains the causes of poor health of the affected population (people's lack of understanding of real risks feeds their anxiety and radiophobia which, along with economic hardships, explains their poor health). This view of the public and related “simplification” of scientific accounts complement the production of invisibility of

[52] Susan Leigh Star (1989) provides an analysis of uncertainty in scientific work. Her work points out that management of uncertainty is common in any scientific research. The strategy of “reducing to certainty” described in this chapter goes beyond common practices, denying the existence of areas that cannot be accounted for by current theories.

radiation effects through scientific practices, or, in other words, construction of "regimes of imperceptibility" (Murphy 2006).

The production of invisibility—that so far appeared as discursive "simplifications" in scientific reports and "regimes of imperceptibility" in scientific studies—becomes even more complex and multi-layered after 2002. Following a period of stark disagreement with the local scientists and local government, the UN organizations have reframed the Chernobyl problem as socio-economic rather than radiological. The new approach simultaneously reaffirms the same old perspective claiming minimal radiological effects from the accident, and the same old view of the public, but also opens new ways of the production of invisibility of 'Chernobyl' in general, including through economic policy recommendations for the local government. These changes have different implications in different dialogical contexts: in the Western media, in the relationship between the UN and the local government, and in applied projects based on the new approach. The latter—applied international projects—both inherit the UN perspective and transform it in practice, as they actually engage the perspectives of the local populations. [53]

My analysis of the international nuclear experts' perspective relies on their Chernobyl reports as the main source. Before we turn to this analysis, two background descriptions are needed: first, a more nuanced summary of how, according to Wynne (2005), regulatory science institutions interpret the public and its concerns about science;

[53] Charles Briggs (2003a, 2003b) in his cholera, study argues that top-down, a priori faulty models of the public depend on the actual exclusion of the affected populations.

and second, a background description of the international nuclear organizations and some of the challenges that the Chernobyl accident presented for them.

## Institutional View of the Public and Public Concerns about Science

The view of the public held by regulatory science institutions includes a particular interpretation of how the public relates to science. Wynne argues that science institutions interpret public concerns narrowly as concerns about risks and, even more specifically, "risks" as defined by institutional science. Thus, complex public attitudes are narrowed to "risk perception" (2005). As a result, scientific assessments are viewed as creating "the public meaning of the issues"; they do more than merely "inform public and policy deliberations" (Wynne 2005, 83). This overextension of the objectives of scientific information and corresponding reduction of the context and scope of public concerns leads to interpreting disagreeing reactions from the public as "either refusal to believe, or inability to understand the quantified risk science—that is, anti-science or ignorance" (Wynne 2005, 83). The oversimplistic view of "the public" mirrors bracketing of the complexity of the scientific knowledge itself:

> [T]he discourse of risk assessments which, thanks to the presumption that public concerns are just risk concerns, is supposed to be the scientific reassurance of public concerns here, inevitably denies the unknowns which always beset such scientific justifications. Thus it denies the basis of public concerns, and its own lack of control. (2005, 69)

This argument about the relationship between "systematic simplification" and experts' claims to control and authority is critical for the analysis of how the Chernobyl effects are interpreted by the experts from the International Atomic Energy Agency (IAEA), United Nations Committee on the Effects of Atomic Radiation (UNSCEAR), and World Health Organization (WHO).

**Perspective of the UN Organizations: International Atomic Energy Agency**

Independent observers have commented on the conflicting role of the International Atomic Energy Agency: the mission of the Agency is to both promote nuclear energy use and establish nuclear safety standards. [54] Analysis of how the Agency—along with two other organizations, UNSCEAR and ICRP (the International Commission on Radiation Protection) [55]—shape international nuclear standards is outside of the scope of this work. However, it is wise to remember that whether or not established standards (and underlying scientific theories) are adequate depends not just on the level of the expertise of the scientists, but also their organizational and disciplinary practices (Jasanoff 1990, 2003; Murphy 2006). [56]

[54] See Fischer (1997) for a description of the history and mandate of the Agency.

[55] The ICRP is an NGO, not a UN organization. Rosalie Bertell (2005) notes that many of the UNSCEAR members are or have been members of the ICRP Main Committee. It is commonly argued that the ICRP has close ties to the nuclear industry. The ICRP only provides recommendations for nuclear safety standards, but few governments challenge their recommendations and set their own standards (Bertell 2005). Bertell and other critics argue that this leads to a conflict of interest: "No other industry is allowed to monitor itself" (2005).

[56] The factors to be considered include accountability of the scientists to a higher authority such as courts or the public (Jasanoff 1990), and whether there is a system of independent watchdogs in place (Gofman 1994). John Gofman (1990, 1994) argues that independent experts on radiation health effects are exceptionally rare: experts are typically appointed by the leadership of state nuclear programs or by governments (since programs related to radiation and its effects are typically controlled by the government). Methodological "blind spots" should also be considered. For example, Bertell (2005) argues the ICRP approaches prioritize radiation physics over radiobiological methods that would be more sensitive in this case. Sharon Stephens (2002) observes that studies underlying nuclear safety standards have been based on particular groups of people (A-bomb survivors or nuclear power plant workers), and their results might not be generalizable for other groups and contexts.

Chernobyl challenged the Agency's mission to advance the uses of nuclear power, [57] but it strengthened the Agency's own role in establishing nuclear safety standards (Fischer 1997). Perhaps the largest problem posed by Chernobyl in terms of advancement of nuclear power was the public perception of its safety; management of public fears appeared to be crucial for advancing nuclear energy. Hans Blix, Director General of the IAEA (1981-1997), said in 1991 that, "the future of nuclear power depends essentially on two factors: how well and how safely it actually performs and how well and how safely it is perceived to perform" (quoted in Fischer 1997, 171).

Sharon Stephens argues that the international nuclear community's response to the challenge was to reassert their "scientific control" over the areas of uncertainty and to attempt to manage Chernobyl-related public fears (2002). This included affirming experts' control over "the apparent chaos of reported health and environment consequences" of the accident, reaffirming "solid scientific grounds for current policies," and attempting to harmonize national safety standards (2002, 91). Expert opinions had to be presented as "one-voiced" (2002, 92). Achieving these objectives relied in part on maintaining the boundary between the experts and the public, especially the affected population. Rational, scientific conclusions of the experts were juxtaposed with the "irrational, uneducated, emotional, and sometimes even hysterical" affected population (2002, 108). Crucial to these efforts was also the boundary between "here" and "there": "Chernobyl will not [and cannot] happen here" (2002, 108). For Stephens, this was an

---

[57] For a decade following the accident, the number of new nuclear power plants built in the West has shrunk to almost zero (Fischer 1997, 2).

attempt to defend “basically undemocratic, 'top down' practices of radiation policy formation” (Gould quoted in Stephens 2002, 91).

**Perspective of the UN Organizations: World Health Organization**

What might appear puzzling is the perspective of the World Health Organization and the extent to which it mirrors the IAEA's view on radiation health effects. WHO's complicity—manifested particularly clearly after Chernobyl—has been linked to the 1959 agreement between the IAEA and WHO. [58] The agreement has established the Agency's control over the information distributed to the public. It stipulates that WHO research programs are subject to consultation with the IAEA, and their results are not to be released if they interfere with the operation of the Agency. Consequently, the IAEA, and not WHO, took the leading role in estimating Chernobyl consequences. The structural position of these two organizations within the UN system also appears to privilege the IAEA (the IAEA reports directly to the UN Security Council, while WHO reports to the Economic and Social Council). When asked why the proceedings of the 1995 Chernobyl conference have never been published, Hiroshi Nakajima, the former Director-General of the World Health Organization (1988-1998), replied that it was organized jointly with the IAEA and, “where economic affairs are concerned, for

[58] On April 26, 2007, a number of international civil organizations organized “International Day of Symbolic Action” (21st anniversary of the catastrophe at Chernobyl) and the start of “an indefinite demonstration” in front of the WHO building in Geneva, Switzerland. The organizers were demanding amendment to the 1959 agreement between the WHO and IAEA (WHA 12.40 approved by the 12th World Health Assembly on 28 May 1959). See http://www.independentwho.info. Dr. Rosalie Bertell (1999), the former President of the International Institute of Concern for Public Health and one of the leading critics of the nuclear industry, has also called for the amendment of the agreement.

[military or civic] use of nuclear energy, they [the IAEA] have the ruling authority" (*Nuclear Controversies* 2003). [59]

We now turn to analysis of the international nuclear experts' discourse around the Chernobyl consequences and the strategic role that a model of the public plays in this discourse.

## Reducing to Certainty

### Authoritative Knowledge and Non-Knowledge

According to Chris Park, "IAEA had won its battle colours at Chernobyl" (1989, 140). Park refers to the point (also mentioned above) that the accident strengthened the role and authority of the Agency as a nuclear safety guard. One of the achievements of the Agency was establishing exchange of information with the Soviets following a period of silence after the accident. Particularly important was the Soviet report on the causes of the accident, delivered at the IAEA Post-Accident Review Meeting in Vienna (August 25-29, 1986). The report "was welcomed internationally for the light it threw on the whole incident" (Park 1989, 147). The IAEA experts fully accepted the Soviet interpretation of the causes of the accident and its radiological consequences. Later, the local scientists--that is, scientists from the former Soviet Republics who are not part of what is sometimes referred to as Leonid Ilyin's school, prevalent at the Institute of

[59] The documentary *Nuclear Controversies* (2003) features the 2001 Kiev conference on Chernobyl consequences and it illustrates conflicting expert perspectives on Chernobyl effects.

Physics in Moscow—would describe the 1986 Soviet report as false information (Malko 1998). [60]

Adriana Petryna (2002) points out that bracketing areas of uncertainty and selective approach to radiological data provided the foundation for production of authoritative knowledge—as articulated by the Soviets and endorsed by the IAEA experts. She describes the Soviet presentation of the report this way: "Buttressed by crude maps, the Soviet truth (as presented to the IAEA) prevailed above and beyond observable evidence and realities of the plume; that truth authorized a domain of government activity and limited intervention. Facts that did not support this domain were either disregarded or eliminated" (2002, 38). Petryna makes an important argument that non-knowledge or bracketing the complexity of the situation is essential to sustaining the control and authority of the Soviet government and its experts: "A catastrophe whose scale was unimaginable, difficult to map, and 'saturating' became manageable through a particular dynamic: non-knowledge became crucial to deployment of authoritative knowledge, especially as it applied to the management of exposed populations" (Petryna 2002, 39). The link between non-knowledge and establishment of authoritative knowledge might be not accidental but crucial.

In practice, production of non-knowledge is a multi-layered process. It includes actual loss or destruction of data: not recording or misreporting doses, misdiagnosing affected populations, and retrospective altering of the data (Medvedev 1992; Yaroshinskaya 1998). It also refers to the conditions of secrecy: the report itself—and all

[60] The IAEA experts fully accepted the Soviet reasons for the accident itself, but this position was changed in 1993. The Soviet experts attributed causes of the accident to "a violation by the Chernobyl NPP personnel of the procedures of nuclear reactor operation developed in the USSR" (Malko 1998, 5).

information related to the accident—was classified information in the Soviet Union until 1989 (Malko 1998). Production of non-knowledge also includes “systematic simplification” (Wynne 2005) and production of “regimes of imperceptibility” (Murphy 2006). The 1986 Soviet report claimed that long-term radiological health consequences of the accident would be *impossible to observe.* This "imperceptibility" of the consequences depends also on how they are made observable, e.g., criteria for calculations and how the calculations were done.[61]

**Threats to Authoritative Knowledge and Locating the Problem in the Heads of the Public**

As described in the previous chapter, visibility of the Chernobyl problems, including public awareness of the scope of the contamination and of the extent of the Soviet cover-up, exploded in the first half of 1989. The local scientists began expressing their disagreement with the proposed Soviet radiation protection measures and specifically the so-called “35 rem” or "Safe Living" concept (see next chapter); public concerns over radiation health effects were rising. The Soviet government invited three WHO experts (with strong ties to the nuclear community) [62] to visit Belarus and to participate in the meeting at the Belarusian Academy of Sciences (together with the key Soviet radiation medicine experts) in June 1989. The international experts supported the Soviet concept and even proposed higher thresholds (Malko 1998). Their report to the

[61] The report claimed that immediate deterministic effects (acute radiation sickness) were limited to the Chernobyl personnel and firemen. Description of the health effects among the population was limited to calculations of the increase in cancer mortality (only cancer and only *mortality* from it). This increase was established to be 0.05% of the existing spontaneous mortality from cancer—calculated for the population of the whole European part of the Soviet Union, 75 million (Malko 1998). Thus, the increase was “negligible” (Malko 1998).

Soviet government rejected a possibility of radiation-induced health effects. It included the following infamous statement, asserting their own expertise, discrediting local scientists, and utilizing a particular model of the public:

> [S]cientists who are not well versed in radiation effects have attributed various biological and health effects to radiation exposure. These changes cannot be attributed to radiation... and are much more likely to be due to psychological factors and stress. Attributing these effects to radiation only increases the psychological pressure in the population and provokes additional stress-related health problems, it also undermines confidence in the competence of the radiation specialists. This has in turn, led to doubts over the proposed values. Urgent consideration should be given to the institution of an education programme to overcome this mistrust by ensuring that the public and scientists in allied fields can properly appreciate the proposals to protect the population (Quoted in Malko 1998, 8).

The quote highlights the perceived connection between certainty of experts' statements and public trust (i.e., whether the public trusts the experts or doubts the thresholds they propose). Furthermore, *health* of the public is assumed to depend on presenting them with information that is certain and in agreement with traditionally established knowledge about radiation effects. Implied is also the need for unanimity of experts' statements.

The statement—and the later assessments by the international radiation experts described below—suggests that estimating "psychological pressure" requires no proof. Below, we will see that the authority of nuclear experts is presumed sufficient for diagnosing populations with anxiety and radiophobia (fear of radiation). Methodological requirements of psychology or other related disciplines are not acknowledged or observed; the references locating the problem "in the head" are never adequately

---

[62] Malko (1998) lists members of this group: Dr. D. Beninson, Chairman of the ICRP, Director of License Department of Argentina Atomic Energy Commission; Prof. P. Pellerin, Chief of Radiation Protection Services of the French Health Ministry, member of the ICRP; and Dr. P.J. Waigh, Radiation Scientist of the WHO Division of Environmental Health.

substantiated. Locating the problem in the head is akin to what in science studies is referred to as “blackboxing”; the causes of poor health no longer have to be or can be investigated in the world external to the affected populations and are now fully contained within the individuals themselves.

### The Production of Invisibility in the International Chernobyl Project and Other International Studies

With increasing resistance from the Belarusian scientists and with increasing awareness and protests from the affected populations, “it became clear to the Soviet leaders that on the question of Chernobyl they no longer enjoyed the trust of their own people. ... The eminence and experience of the nation's leading scientists counted for nothing” (Read 1993, 305). In October 1989 the Soviet government requested assistance from the International Atomic Energy Agency to carry out assessment of the proposed Soviet concept and undertake radiation protection measures. Explicit was the goal of “instilling confidence in the affected populations” and “stamping out 'obscurantism' and 'sensationalism'” (Petryna 2002, 52). The state was also “virtually broke” (Read 1993), and lower radiation safety thresholds would require more resources. On February 20, 1990, the Belarusian SSR issued an official appeal for cooperation and humanitarian assistance in dealing with the Chernobyl consequences; by that time, Belarus had adopted its own Program of Liquidation of the Consequences of the Chernobyl Accident—with different criteria for radiological (and social) protection and lower thresholds (see chapter 5).

In response to the Soviet request, the IAEA coordinated the International Chernobyl Project. The main part of it was carried out in May 1990-January 1991; the Project involved 50 research missions and 220 scientists (Gofman 1994; Read 1993; Belarus 2001). The report from the Project, presented in Vienna in May 21-24, 1991, echoed the earlier estimates made by the Soviet experts, disregarded the data presented by the local scientists, and found no health effects that could be attributed to radiation. Indeed, the project experts offered the dose estimates that were two or three times lower than those made by the Institute of Biophysics in Moscow (Read 1993). On the basis of these doses it was concluded (again) that radiation effects (defined as "future increases over the natural incidence of cancers or hereditary effects") "would be difficult to discern, even in large and well designed long term epidemiological studies" (quoted in Malko 1998, 6). Other health effects were described as not related to radiation. "Failures" of the local studies, which had connected general somatic disorders to radiation effects, were attributed to lack of equipment and trained personnel, and poor access to scientific literature. At the same time, the Project experts concluded that: "The accident had substantial negative psychological consequences in terms of anxiety and stress due to the continuing and high levels of uncertainty, the occurrence of which extended beyond the contaminated areas of concern. These were compounded by socio-economic and political changes occurring in the USSR" (quoted in Malko 1998, 6).

Conclusions of the Project were criticized both locally, in the affected Republics, and internationally; they were often described as a whitewash serving the interests of advancing nuclear energy. The critics pointed out that some things were obviously excluded; for example, the study excluded 600,000 “liquidators” (accident clean-up workers) who worked to contain the accident and received high doses.

That the Project excluded a significant part of the most exposed population is not necessarily "what's wrong" with it,[63] but it points to possible systematic production of "imperceptibility" of radiation effects. Below I describe several key ways to create "regimes of imperceptibility." The description is based on criticisms of the Project's methodology and results, and similar criticisms of other international studies, but it is intended to illustrate the *range* of possible ways to produce and sustain imperceptibility of Chernobyl radiation effects.

*Selection of criteria and indicators*. What indicators are chosen as "appropriate" for demonstrating radiation-related damage or excluded as irrelevant determines investigation outcomes (Petryna 2002). The choice of criteria is affected by institutional goals and values. The data that does not fit "a normative notion of risk... quantified in the correct biological context [...], with the correct biological value, and in the correct representational form" might be ignored as irrelevant (Petryna 2002, 54). Petryna argues that a "firm grasp" over what constitutes the criteria for radiation-induced health damage was used by the IAEA experts as the grounds for their claims to authority. Correspondingly, their willingness to steadfastly ignore raw data that would not fit established criteria is what the international nuclear experts have to be held accountable for. For example, “hot particles” burning lung tissues were both acknowledged as a

[63] Fischer (1997) argues that it would have been difficult to locate the liquidators; Read (1993) argues that the Project experts had not been asked to study radiation effects in the liquidators.

phenomenon and dismissed as irrelevant since they did not fit the proper criteria and representational forms (Petryna 2002).

A priori *limiting the field of study*. John Gofman (1990, 1994) makes a related argument: the IAEA (and later, WHO) studies *a priori* limited the field of research to radiation health effects that have already been established; other potential radiation effects were *a priori* excluded. For example, in the IPHECA study (International Program on the Health Effects of the Chernobyl Accident, convened in 1991) conducted by World Health Organization, the areas of research were limited to traditionally defined radiological effects[64] (Gofman 1994) with one addition: psychological stress.

*Manipulating the data*. Gofman lists ways to handle the data that corrupt validity of scientific results: "the retroactive alteration of databases, the replacement of actual observations by preferred hypotheses, the artificial constraint of equations to rule out certain dose-responses, the subdivision of data until even the largest database becomes inconclusive, and more" (1990, 1994, 4). He ties the Chernobyl Project and other studies by the IAEA and WHO with all of these violations. Gofman further insists on "the importance of keeping a constant structure [of databases and categories] and keeping the same people [cohorts] together throughout the full course of a prospective study" as a way minimizing the effects of biases on shaping the data (1990, 20). [65]

*Disregarding the local context*. Related to the previous point is manipulating the data by way of disregarding local conditions that shape radiation doses and their effects,

[64] WHO-IPHECA project was meant to include five pilot projects over the period of three years, focusing on: thyroid, leucosis, brain disorders due to prenatal radiation, study of the epidemic registers, and psychological stress (Belarus 2001)
[65] Gofram argues that continuity of categories is "the main barrier against the entry of bias, both conscious and unconscious" (Gofman 1990, 5-2). See Bowker (2005a) for the discussion of management of categories.

including socio-economic conditions. For example, one of the criticism of the Chernobyl Project was that residents were tested in the fall rather than in the winter (farmers' diet and general physical condition typically improves after summer).

Vasilii Nesterenko (1998) offers an even more striking example with his description of the German testing program intended to measure internal accumulations of radiation in the residents of the affected areas in Belarus. The testing focused on the town residents; testing of the rural populations was limited to just one village. Since accumulation doses of rural residents were generally much higher (see chapter 6), the testing program produced lower average doses. [66]

Gofman (1990, 1994; see also Bertell 2005) relates these methodological mishandlings to the lack of independent experts participating in these studies. Conflict of interest—for example, when experts work for the Agency dedicated to advancement of nuclear power—creates an obvious bias in their studies. Gofman points out that what is missing and what is much needed is a system of independent watchdogs, i.e., independent experts re-examining the findings.

## Implications for Humanitarian Assistance to Belarus

The results of the International Chernobyl Project and later international studies affected humanitarian assistance for which the Belarusian government was appealing. In turn, the lack of international recognition and international assistance affected the politics

---

[66] Nesterenko (1998) argues that these measurements were later used to justify lifting radiation protection measures in areas with the level of surface contamination 1-5 Ci/km². These dose estimates were lower than results of measurements by Nesterenko's Institute of Radiation Safety "Belrad." Skryabin (1998) found that internal accumulations of residents of small villages were up to five times higher than internal accumulations of town residents (see chapter 6).

of the Belarusian government, including the official reframing of Chernobyl as a socio-economic problem (described in chapter 2), and changes to management of state-controlled Chernobyl research institutions (which is the topic of chapter 4).

Timing of the first UN efforts to organize assistance for the Chernobyl-affected countries coincided with the release of the Chernobyl Project results. The UN Joint Plan *"On International Co-operation to address and mitigate the consequences of the accident at the Chernobyl Nuclear Power Plant"* was released in March 1991. Conclusions of the International Chernobyl Report were released on May 21, 1991; the publication of the report itself was delayed until October 1991 (Gofman 1994). The UN plan was submitted to the Chernobyl Pledging Conference on September 20 of the same year (Belarus 2001, 86-87). The outcome of the pledging conference was less than one million in US dollars (less than 1% of the amount requested by the three most affected Soviet Republics). The second international pledging meeting in 1998 collected one and a half million (2% of the requested amounts) [67] (Belarus 2001).

Interestingly, the limited scope of the international assistance from the UN organizations contrasts with humanitarian aid provided by international charities; indeed, the 2002 UNDP and UNICEF report on Chernobyl has referred to these efforts as "possibly the largest and the most sustained international voluntary welfare program in human history" ( UNDP and UNICEF 2002, 61).

---

[67] Out of this amount, one million was "a targeted US deposit on implementation of Ukrainian projects" (Belarus 2001, 87).

**The Power of Comprehensive (and Well-Publicized) Reports**

The second major assessment of the Chernobyl consequences coordinated by the IAEA (together with the European Commission and the WHO) was the conference *One Decade After Chernobyl* held in Vienna on April 8-12, 1996. One radiation health effect that was finally acknowledged by the international nuclear experts—after several years of disagreement with the local scientists—was thyroid cancer in children. For the local experts, it simply could no longer be denied (based on the pre-Chernobyl theories of radiation effects) because of the high significance of the increase (the average number of thyroid cancers in children in Belarus before the accident was one per year total) and striking geographic distribution (Malko 1998).

In terms of its estimates of radiological (and psychological) effects, the Conference summary report repeated the previous statements from the international nuclear experts. Increases in the rates of cancer and hereditary effects among the affected populations would not be "detectable against a spontaneous rate." The apparent rise of "non-specific detrimental health effects other than cancer" was interpreted to be a result of extensive medical examination of exposed populations; the report further stated that: "[a]ny such increases, if real, might also reflect effects of stress and anxiety."

In "Psychological consequences," a separate section of the report, the affected population was diagnosed with "significant psychological health disorders and symptoms... such as anxiety, depression and various psychosomatic disorders attributable to mental distress." These psychological effects could also be produced by "economic hardship and dissolution of the USSR," and, significantly, by misperception of radiation risks: "The distress caused by this misperception [...] of radiation risks is extremely harmful to people" (*One Decade After Chernobyl* 1997, 7). The report appeared to assume that health of the affected population depended on consensus among the experts. Disagreement among the experts, as well as continuing radiation protection measures, might worsen people's psychological effects and psychosomatic symptoms:

> The lack of consensus about the accident's consequences and the politicized way in which they have been dealt with had led to psychological effects among the populations that are extensive, serious and long lasting. ... The effects are being prolonged by the protracted debate over radiation risks, countermeasures and general social policy, and also by the occurrence of thyroid cancers attributed to the early exposures (*One Decade After Chernobyl* 1997, 7).

> [T]he continuing debate over radiation risks and countermeasures, combined with the fact that effects of the early exposures are now being seen (i.e. the significant rise in thyroid cancers among children), may prolong the symptoms (*One Decade After Chernobyl* 1997, 12).

> In view of the low risk associated with the present radiation levels in most of the 'contaminated' areas, the benefits of future efforts to reduce doses still further to the public would be outweighed by the negative economic, social and psychological impacts (*One Decade After Chernobyl* 1997, 13).

In conclusion, the summary report of the conference argues that, "The symptoms such as anxiety associated with mental stress may be among the major legacies of the accident" (1997, 13).

The same view of the Chernobyl radiation-induced effects and the same view of the Chernobyl-affected populations appears in the recent scientific report "Exposures and Effects of the Chernobyl Accident" produced by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR 2000, 2002).[68] The scope and size of the report make it perhaps the most comprehensive source on Chernobyl consequences, and while numerous experts and organizations published their rebuttals to the conclusions of

---

[68] The UNSCEAR reports (2000, 2002) claims the same absence of significant radiation-induced effects and emphasizes people's fear of radiation, anxiety and stress from the economic situation—allegedly passed from parents to children—and the causes of the population's poor health.

the report (e.g. Belarus 2001; Bertell 2005; Edwards 2006), none of the sources are as comprehensive or as publicized (the IAEA and UNSCEAR reports are also easily accessible online). The IAEA and UNSCEAR estimates of the consequences have come to represent the "official position" on Chernobyl by the Western media (e.g. Stone 2006).

## Reframing and Consensus-Building

The national reports on Chernobyl consequences describe the “donor fatigue” at the end of the 1990s (Belarus 2001, 2003). In the early 2000s, international interest appeared to have been revived with a new conceptual approach to Chernobyl: the emphasis shifted from assistance based on radiological consequences to socio-economic consequences of Chernobyl and “sustainable development” of the affected regions. [69] The Belarusian government was the first among the governments of the three most affected countries to turn to this approach (Belarus 2003). From the international perspective, two reports marked the change: the UNDP and UNICEF joint report, released in February 2002, and the World Bank report, released in April of the same year. The UNDP and UNICEF report “The Human Consequences of the Chernobyl Nuclear Accident: A Strategy for Recovery” outlined the directions of the new approach: socio-economic rehabilitation, normalization of life, and changing the “culture of dependency” in the affected regions of the three affected countries (Belarus, Ukraine, and the Russian

[69] One local UN manager describes this transformation rather cynically: “Chernobyl is a brand which one can get funding for. According to the official statistics, we do not have a problem with children’s oncology, but there is a real socio-economic problem in the affected regions. I think somebody just came up with a brilliant idea to stress the economic factors in the Chernobyl regions.”

Federation). The World Bank report "Belarus: Chernobyl Review" reiterated a similar perspective specifically for the Belarusian context.

**UNDP and UNICEF and the World Bank Reports: Reframing and the Production of Invisibility**

The two reports outline the new approach to international assistance directed at building the "local capacity" and sustainable development of the affected territories. The approach is meant as "holistic": "integrating health, ecological and economic measures" (UNDP and UNICEF 2002, 19). In effect, it dissociates international Chernobyl aid from radiological consequences. The World Bank report recommends, for example, that: "In approaching the donor community, Belarus should shift its attention from calculating the impact of the accident to developing forward looking activities directed at economic development and improvement in the quality of life of the affected people" (2002, 53).

Policies recommended by the reports make an important emphasis on social infrastructures in the affected regions, encourage local initiatives, and underline the importance of fighting stigmatization of the affected territories. In principle, the value of a "holistic approach" cannot be underestimated: radiological or health issues are part of the "broader context" for both the affected populations and the government. The reports, however, are also grounded in a particular view of the radiological consequences and of the affected population, and it is from that perspective that they make their socio-economic recommendations. Despite being justified by socio-economic reasons, the recommended policies also define where the danger is and who has been or is at risk. The politics of the production of invisibility of the Chernobyl effects becomes more complicated; the socio-economic reframing adds a new dimension to it (see below), but at the core there is the same symmetrical "simplification" of the radiological effects and of needs and capacities of the local population, combined with the same argument for creating authoritative mechanisms of knowledge production. The UNDP and UNICEF report describes the radiological effects exactly in accordance with the UNSCEAR perspective (the radiation effects are insignificant; there is no “excess” of mortality beyond what is statistically expected). [70] The World Bank presents some range of scientific opinions (in the appendix), but the report reaffirms that the radiation factor was not the main reason for “depressed demographic tendencies and high mortality rate” (2002, 81) [71] and presents policy recommendations highly that are compatible with the perspectives of the nuclear experts (see below).

The model of the public in both of the reports is a familiar one—just with slightly different accents. The reports comment that people living on the affected territories have been labeled “victims of Chernobyl” and that they perceive themselves as having suffered from Chernobyl; they believe that the accident had negative health consequences. In reality, say the reports, the radiation risks are minimal, and the real issue is severe socio-economic and psychological pressure that people are under. People feel lack of control over their lives; they have developed a “victim mentality and dependency on state support” (World Bank 2002, 46). Psychological effects of the accident include distrust,

[70] According to the UNDP and UNICEF report, morbidity on the affected territories “reflects the broader pattern of the former Soviet Union.” The only radiation effect mentioned is thyroid cancer (the report also suggests that breast cancer and some other health effects should be investigated further). With the current low doses, no health effects will not be “statistically detected” (2002, 50).

[71] The World Bank reports states that it is “difficult to separate direct and indirect consequences of the radiation” (2002, 81). The health status is worse on the affected territories, and the mortality is higher; thyroid cancer and possibly other diseases are the effect of the radiation factor. Chernobyl-related factors, however, are not the major cause of death.

apathy, and the sense of victimization (World Bank 2002). These effects indicate that the government has failed to increase trust and reduce anxiety in the public; educational efforts have not been receiving enough attention within the structure of the governmental Chernobyl programs. The new approach aims to "give individuals and communities control over their own futures" (UNDP and UNICEF 2002, 19), to provide the public with truthful information about the "real risks" and win back their trust (the report notes that public information should acknowledge the areas of doubt). At the same time, these efforts might not be effective for people with low income unless educational efforts are supplemented with measures helping increase it.

This "psychosocial dimension of health" requires creating a "mechanism to provide authoritative opinions on these issues and ensure that properly designed and impartial research is carried out" (UNDP and UNICEF 2002, 6). The UNDP and UNICEF report suggests creating a panel of independent experts who would evaluate new research on Chernobyl issues, set priorities for research, and inform the public about the real extent of the consequences. This is important so that the post-Chernobyl knowledge is not "lost forever" (UNDP and UNICEF 2002, 6), and also because of the effects the lack of consensus among experts and misperception of radiation risks has on the affected population:

> This firm belief in radiation-induced diseases, exacerbated by the distrust of information provided by the Government and the international community and the lack of consensus among local and international specialists on the ways to protect the population from elevated levels of ionizing radiation, has been a major factor in fostering a depressed health situation and an impaired state of well-being in the affected population. Many people have adopted an attitude of apathy and fatalism arising from the perceived lack of control over their lives (World Bank 2002, 10).

This view of the public continues to be markedly oversimplified (see chapter 6). The need for certainty is projected as residing with the public; it is again suggested that lack of consensus among experts adversely affects public health. The public is conceptualized as an essentially monolithic, undifferentiated group. "The population"—and not groups of people defined by socio-demographic, psychological or circumstantial characteristics—display psychological effects and psychosomatic health problems (again made worse by people's economic hardships and now also by the sense of "victimization").

As I have suggested in the introduction to this chapter, the socio-economic reframing of Chernobyl on the international level does not just reaffirm the same models of the radiological effects and of the public (corresponding to the experts' own control and authority), but also creates new ways in which invisibility of the Chernobyl effects is produced. The UNDP and UNICEF and the World Bank reports argue that the government cannot afford the current policies; they are already underfunded. As noted above, the state social protection policies are also said to create "the sense of victimization and dependency" (World Bank 2002, 10). [72] The solution is to "streamline and refocus" all of these state Chernobyl-related policies. I argue that recommended changes narrow public visibility of the Chernobyl problems in at least three critical ways: they narrow Chernobyl-related categories, cut publicly visible programs, and blend Chernobyl-related issues with broader societal ones. This result and the recommended

---

[72] I assume that "dependency" referred to here is psychological dependency and not economic dependency, since the reports also note that the actual benefits received by the populations are minimal and non-significant. The reports also refer to "culture of dependency."

policies that would achieve it are predicated on the experts' understanding of the (minimal) radiation health effects and radiation risks.

*1. Narrowing down the categories of the affected population, affected territories, and radiation-related health effects.* The reports argue that definitions of who qualifies for benefits and compensations on the basis of their Chernobyl-related status should be made more "stringent." For example, compensations should be on the basis of "actual injury," rather than "exposure to risk." [73] Chernobyl-related assistance should be refocused to target only the most economically vulnerable groups and those whose health has been affected by radiation (thyroid cancer patients). Mass screening of the Chernobyl groups should be replaced with targeted screening. No special measures are needed on territories with levels of contamination below 15 Ci/km$^2$. All of these changes strongly reflect the perspective of the international experts; no attempt is made to account for the complexity of the actual circumstance (i.e., whether or not people have channels to prove that their health effects are radiation-related, or the range of internal doses in the areas with mild radioactive contamination).

*2. Eliminating the publicly visible "Chernobyl programs."* Practically all mass Chernobyl-related programs have to be reconsidered: health recuperation programs, free meals at schools, free health care, Chernobyl-related benefits and compensations, and others. A number of these programs are preventative measures (e.g., the first two in the list above) and, according to the reports, they are not based on the actual health status of the recipients. Programs that tie benefits and compensations to the place of residence

[73] The World Bank report, for example, questions that the people living in the areas of periodic radiation control "be included in the list of beneficiaries if the causal connection of the accident and health status or worsening working and living conditions has not been established" (2002, 81).

(exposure to increased levels of radiation) should be discontinued (as problematic as Chernobyl benefits are, these are the programs that have sustained the public visibility of Chernobyl since the early 1990s). The reports recommend testing programs for their cost-effectiveness, e.g., cost-effectiveness of production of "clean" food or the thyroid treatment. Attention should be focused on mainstream health care and social services, and epidemiological research.

*3. Blending Chernobyl problems with general problems.* With (indiscriminate) emphasis on mainstream health care and social service, Chernobyl-specific problems blend in with general societal issues. Even by the reports' own admission, Chernobyl problems thus defined are generic in nature, and countrywide reforms are needed. It is not clear, for example, what distinguishes economic problems (poverty) on the affected territories—the focus of the new approach—from the situation in other rural areas of Belarus. Other examples of "blending" are suggestions for international voluntary assistance projects to frame their objectives in broader terms and not relate them to health specifically.[74] Similarly, it is argued that radiation protection education should be done as part of general health education.

Reducing visibility is not inherently unethical or problematic (see Conclusion). The reports describe these policy changes as a "process of healing," but also acknowledge that, "Strong barriers to change exist in the fears and the patterns of behavior of the affected population and the wider community, and powerful vested interests are involved. ... A log-jam has developed of expectations and assumptions that

[74] According to this report, "the main downside" is that such international health recuperation programs (these programs arrange for the Belarusian children from the affected territories to spend time abroad) "may perpetuate inaccurate and negative stereotypes about life in the affected areas, both in the minds of the young people and in the host community" (UNDP and UNICEF 2002, 61).

no longer reflect the current realities" (UNDP and UNICEF 2002, 4). The production of invisibility is a matter of *who* defines these realities.

**UN Chernobyl Forum**

The most significant attempt at achieving consensus and overcoming differences has been the establishment of the Chernobyl Forum in February 2003. Creation of the Forum followed the UNDP and UNICEF report and establishment of the new UN approach to Chernobyl. It was organized at the IAEA initiative, following the discussions between the IAEA and the Belarusian government in 2003; the Forum now includes representatives of all three most affected countries, along with a number of UN organizations,[75] and seeks to issue "authoritative statements and recommendations that will contribute to overcoming the widespread disagreements over the long-term impact of the Chernobyl accident" (IAEA 2004, 38).[76] The need for "authoritative" information and consensus-building continues to be justified with the view of the affected populations that is identical to the reports described above; the radiological estimates have not changed either. The IAEA website quotes Mr. Abel Gonzalez, IAEA Director of Radiation and Waste Safety:

> People living in the affected villages are very distressed because the information they receive - from one expert after another turning up there - is inconsistent. People living there are afraid for their children. The aim of the Forum is not to repeat the thousands of studies already done, but to give them authoritative,

[75] The Forum includes United Nations Development Programme (UNDP), Food and Agriculture Organization (FAO), United Nations Environmental Program (UNEP), United Nations Office for Coordination of Humanitarian Affairs (UN-OCHA), United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR).

[76] This description of the Forum also appears on the IAEA website in a feature story "Forum Sharpens Focus on Human Consequences of Chernobyl Accident," 6 Feb 2003. Available at: http://www.iaea.org/NewsCenter/Features/Chernobyl-15/forum_launched.shtml

> transparent statements that show the factual situation in the aftermath of Chernobyl.[77]

This time informing the public will be done with the help of public information specialists; Mr. Gonzalez promises that, "Public information specialists will be involved in the work of the Forum from the outset." At the same time, the IAEA, WHO, and the Forum are the major sources of "the official information" on the extent of the Chernobyl consequences not in the affected regions, but in the Western media (see table 3.1). Despite, again, numerous rebuttals, the numbers provided by the Forum are quoted extensively in the Western sources (e.g. Stone 2006). The accident and its consequences have been almost completely encapsulated by the IAEA interpretations of it.

**Table 3.1** Western media headlines following the 2005 Chernobyl Forum press-releases, September 2005

| |
|---|
| Little to Fear but Fear Itself |
| False Information Said Worsened Chernobyl |
| Experts Find Reduced Effects of Chernobyl |
| Chernobyl's Harm Was Far Less Than Predicted |
| Chernobyl's Dangers Called Far Exaggerated |
| Chernobyl Legacy Not as Dark as Feared |
| Health Impact of Chernobyl Less than Expected: Report |
| Chernobyl's Dangers Exaggerated |
| Chernobyl Legacy Not as Dark as Feared |
| Chernobyl Toll May Be Less Than Feared |

These headlines match exactly John Gofman's description of the 1991 headlines that appeared in the Western media following the Chernobyl Research Project (Gofman 1994). The headlines above are taken from major editions and news sources, including *The New York Times* and *The Economist*.

Unlike the UNDP and UNICEF and the World Bank reports, the 2005 Chernobyl Forum report describes specifically the ecological and health, not socio-economic,

[77] Available online at: http://www.iaea.org/NewsCenter/News/2004/consequences.html

effects of Chernobyl and provides recommendations to the local governments. However, the model of the psychologically vulnerable population is again used to provide "real" causes of the poor health of the affected populations, and, mirroring the two previous reports, the view of the affected population justifies policy recommendations to the governments of the affected countries. Radiological estimates offered by the Forum (e.g., the Forum's 2005 technical reports and press-releases) agree with the previous statements by the international nuclear experts and, indeed, with the Soviet prognosis. According to the press-release from September 2005, the estimate of total predicted deaths from radiation (4,000) is close to the estimates made by the Soviet experts in 1986. In 2005, "fewer than 50 deaths had been directly attributed to radiation from the disease, almost all among highly exposed rescue workers" (UN Chernobyl Forum 2005). [78]

The real Chernobyl problems, according to the Chernobyl Forum, are informing the public and poverty. Poverty and anxiety are the main health threats, not radiation. The government policies foster people's perception of themselves as "helpless victims"; the policy recommendations are again almost identical to the previous reports and they offer the same measures reducing Chernobyl visibility. The recommendations go so far as to suggest that international charities "rethink their efforts" and "give their activities a broader label than that of Chernobyl" (UN Chernobyl Forum 2005, 46).

The 2005 report also offers recommendations on health care, medical monitoring policy, environmental monitoring and remediation, and research directions. It emphasizes the need for new educational efforts: "Accurate information on living in

---

[78] The only concession is the report's tentative acknowledge of the rise of cardiovascular disease in Russian clean-up workers, though careful examination of influence of confounding factors is suggested.

conditions of low-dose radiation is available, yet it is either not reaching some people, or people are unable to digest it or act upon it." Creation of International Chernobyl Research and Information Network (ICRIN) is mentioned in connection to searching for a new information strategy.

The paradox of the international experts' model of the public is that it is difficult to sustain in practice. Applied projects, including ICRIN, inherit the assumptions and objectives of the UN reports, but interacting with new perspectives—including those of the local population groups—*partially* transforms the models described above. I briefly outline some aspects of this transformation on the example of the two key projects of the new generation: the CORE Programme aimed at improving living conditions of the affected populations and the ICRIN project aimed at providing information for the affected populations. The concluding remarks for this chapter provide a perspective of the local scientists on the complexity of the Chernobyl effects that has been excluded from the international estimates.

## Partial Re-appearance of the Lost Perspectives

Both ICRIN and CORE inherit parts of the view of the population presented in the UNDP and UNICEF report "The Human Consequences."[79] The CORE Programme, for

[79] Establishment of the CORE program followed the 2002 UNDP and UNICEF report on "The Human Consequences," the World Bank report "Belarus: Chernobyl Review," as well as reports of the Heads of Mission of the Ambassadors from the EU about their visits to the affected territories (April 2001 and May 2003), and the report of the experience of the ETHOS project as discussed during the international seminar held in Stolin, Brest oblast, Belarus (15-16 November 2001) (CORE 2003). The ETHOS project, sponsored by the European Union, worked with various groups of the local population to address an aspect of their lives related to radiation protection (NEA 2002).

example, seeks to "return the sense of control to local people." More importantly, however, the Programme aims to "improve the living conditions of the inhabitants of selected districts by reaching out to the people themselves, *helping them to contribute to formulating* specific and common project proposals" (CORE 2003; emphasis added). The Programme solicits local projects in four areas:

- health care and surveillance of health;
- economic and social development;
- radiological quality;[80]
- culture and education of children and youth, and transmission of the memory of the Chernobyl disaster.

Residents of the villages where the projects are solicited have to learn and follow the rules and bureaucratic language of the Programme, but the CORE team members have to gain and keep the people's "trust" in practice and are thus accountable for their actions. Members of the Programme are in the position of having to account for the perspective of the villagers ("I understand these people. I'm from a village myself. My parents would not leave their place either with or without radiation."[81]), and to do the work of translation between perspectives of the local groups, the international representatives, and the state government. The head of the Program, for example, says in her interview that she understands "the position of the people, and on the other hand," she understands the international side of the problem as well. She describes the two

---

[80] Radiation protection is not the sole focus of the Programme, but it still receives attention – in the context of economic activities (i.e., growing produce in order to sell it) that are important to the people. Effectiveness of the CORE activities in reducing internal accumulated doses (radionuclides consumed with produce) was confirmed to me by the Independent Institute of Radiation Safety "Belrad."

[81] Head of the CORE Programme, personal interview.

historical lines leading to the CORE Programme: the history of the government response (and the economic burden of the Chernobyl consequences) and the history of developing international focus on rehabilitation. The power dynamic shaping activities of the Project is more complex (the Program's offices are located literally next door to the offices of the Chernobyl State Committee). It matters tremendously, however, that the Program—starting from its declaration statement—emphasizes civil society participation and "stake holder involvement." The program partners with local NGOs; the CORE team members are aware of the perspectives of the local populations and are in the position to be at least partially accountable for their actions.

At the same time, the Program works with in-built conceptions of risks. They are reflected both in the Program activities (e.g., it works within the zone 15-40 Ci/km$^2$) and in the opinions of the CORE members: from attributing claims of health problems to either chronic stress that people live with or improved diagnostics, to arguing that "*everybody* in Belarus was hit with the iodine in the first days after the accident." It is important that people on the affected territories acquire new habits, which makes it important to educate the residents with the goal of establishing 'practical radiological culture': in the words of the CORE director, "People did not learn to brush their teeth overnight either." What appears to be irrelevant to the CORE activities is the perspective of local scientists. The Program includes agronomists who give advice on growing "clean" produce, and at least one of the senior managing staff (at the time of this research) holds an advanced degree in science. There is, however, no involvement of the local scientific research—or any other perspective other than that of the international nuclear experts—beyond that.

Similarly, the goals of the International Chernobyl Research and Information Network (ICRIN) network and the underlying model of the public reproduce already familiar concerns with the consensus and top-down "informing" the affected populations. Bringing this dynamic one step further, the ICRIN now seeks to inform the public according to the public's "information needs." According to its website, the network's "outlook is consistent with the Chernobyl Forum findings that at the community level, poverty is a bigger threat than radiation." Furthermore, "Consensus reached by the scientists at UN Chernobyl Forum will be followed by the work of ICRIN on distilling its findings and translating into the messages to the affected population." ICRIN information booklet suggests that the network will "authoritatively" compile and disseminate research on Chernobyl "that would respond directly to the information needs" of the affected populations (ICRIN 2003, 5). The goal is "a unified approach based on the information needs of the population"[82]

The ICRIN report assessing information needs of the affected population (2004) includes an overview of historical media coverage of Chernobyl and sociological surveys describing sources of information, attitudes, and interests of the affected population. The report discusses "inadequate perceptions of the risk of radiation" or that "lack of objective information" in the media is the reason for phobias among the affected population (e.g., young mothers); the knowledge of experts is presented as unambiguous and uniform; the results of their expertise are "objective indicators of risk" (ICRIN 2004, 4-23).

---

[82] The concept of ICRIN was elaborated by the Swiss Agency for Development and Cooperation (SDC); the work of the Network is and endorsed by the UN Inter-Agency Task Force on Chernobyl in 2003. The work of the Network is coordinated with the Chernobyl Forum.

Other ICRIN projects signal their adherence to the framework suggested by "The Human Consequences" report, but their work cannot be contained by this framework. A large-scale study of information needs of the affected population by the Belarusian Committee "Children of Chernobyl" relied on interactive methodology appropriating the idea of the traditional village meeting. The study frames its results with reference to the UNDP and UNICEF approach ("So that we can be quoted," by the admission of one of the researchers), but the summary report struggles to make coherent the multitude of perspectives and complexity of the actual socio-economic and administrative circumstances, and some of the results are bitterly critical of both the government and the international projects. Another example is chernobyl.info website, the most visible part of the ICRIN project (developed by the SDC, the Swiss Agency for Development and Cooperation). Description of the Chernobyl health effects on the website start with the position of the UNDP report, but also include references to the findings of the local (Belarusian, Ukrainian, and Russian) scientists. Indeed, this is perhaps the most comprehensive and serious attempt to publicly represent the view of the independent scientists and local scientists (at the time of this study).

Finally, the organizational structure of the international projects is more open and transparent than that of the government bodies. The public visibility of these projects (from TV appearance to advertising the chernobyl.info website on public transport trams in Minsk) and their accessibility and transparency is highly significant to visibility of the Chernobyl issues in Belarus. The staff of the State Committee on Chernobyl is much more willing to discuss ICRIN projects than the work of the Committee itself. Representative of the Department of Science within the Ministry of Health of Belarus have immediately referred me to the CORE Programme: "they would be able to tell you more." This is not necessarily a sign that the government organizations are not performing important Chernobyl-related work, but it does illustrate the role that international projects play in fostering public visibility of Chernobyl—though not its health effects—within the country.

To summarize, the work and effects of the international organizations are more complex and multi-layered; they extend beyond the positions of the international reports. The "simplified" models of both the radiological consequences and the affected public presented in these reports are partially reproduced within the projects—and then somewhat transformed by the perspectives and contexts included in the actual project activities.

## The Value of 'Intimate Knowledge'

The analysis offered in this chapter has connected the values of consensus and certainty of knowledge presented in the international Chernobyl reports to corresponding exclusion of areas of uncertainty and complexity. This effort seeks to reaffirm the authority of the nuclear experts, and it is justified with a "simplified" model of the public or, more specifically, how the relationship of the public to experts' knowledge and authority. Consensus among the experts is portrayed as a goal and (in certain contexts) as already a reality corresponding to the certainty of the expert knowledge. Public unanimity (speaking in 'one voice') of the international experts is striking; in the words of a local radiologist: "But they don't all think that way, do they?"

One of the leading Chernobyl experts in Belarus mentions that the World Health Organization has described the post-Chernobyl circumstances as unique for assessment of the small-dose effects on the whole population. However, according to him, what is missing from the IAEA—and, more broadly, the Western nuclear-related—perspective is "intimate knowledge" of the effects. This "intimate knowledge" is important because of the complexity and unique nature of the situation itself. Describing the complexity of the situation, this leading researcher refers to different types of exposures (external and internal), different types of radionuclides (alfa, beta, and gamma-radiating elements), and the fact that the consequences of chronic exposure to small doses have large delayed effects that could manifest in the life of one generation or in generations ("When it is an acute exposure, then the effects are immediate and then they tail depending on the dose. With small doses, there might be no effect at the beginning, but there can be a significant delayed effect"). There are also specific circumstances to consider, such as non-homogeneous distribution of radionuclides in organs, which leads to higher doses to parts of the organ or tissue,[83] or in-utero exposures (which are particularly dangerous). The leading Belarusian researcher argues that, "These kinds of aspects are not considered."

He adds bitterly: "Nobody knows this. Nobody knows what the delayed consequences are. We are trying to prove these effects, to let the international community know. Scientists who study Chernobyl consequences in Belarus and Ukraine have moved much further and understand nuclear accidents much better than even your

---

[83] For example, iodine deficiency common in Belarus and Ukraine results in thyroid hypofunction; radioactive iodine is accumulated in thyroid in spots and not the whole thyroid is exposed at the same time. It is then likely that part of thyroid will be exposed to a high dose, even if the overall dose on the thyroid is not significant. Malignant formation happens in a certain part of thyroid (*ozlakochestvlenie v kakom-to uchastke*).

[Western] scientists do." The bitterness of the last comment is a reaction to the resistance that this research meets on the part of the IAEA, but also of Western nuclear experts more broadly:

> I talked about it in the US Energy Committee. ... I asked them why they were not interested in Chernobyl research. They told me that they were observing the situation from their satellites. I told them that that was rubbish; they were not going to see anything. They could see that there was an accident, that there was emission, and that some of it went to the atmosphere, but that was pretty much it. You could never see the intimate mechanisms that I showed them on the example of my own scientific data. How could they see that? ... Join in and work with us, there is enough room for everybody to work and learn here. ... There are no joint projects with the US scientists. Or, there was one, but the head of the laboratory was Belarusian.

The researcher offers numerous examples of the lack of understanding and resistance from the nuclear experts from state governments and international nuclear organizations. His bitterness is shared by a number of other local scientists; the following comments are typical: "He who pays the piper, calls the tune [*Kto platit den'gi, tot zakazyvaet muzyku*]. They are afraid for the future of the nuclear industry"; "What we have is a presumption of guilt: we do research and it is assumed to be wrong until proven right"; or "There is a nuclear lobby there, which preaches that nuclear power stations are harmless. There is big money behind it, super-powerful companies." Tamara Belookaya, who reviewed almost a thousand articles on Chernobyl, claiming that most of them do find radiation-induced effects, when asked if she felt hopeless sometimes, replied, "Often and pretty badly."

According to this leading Belarusian scientist, the lack of international acknowledgement is temporary and, even more importantly, that the IAEA experts cannot affect the reality of the situation and the local research:

> As far as I understand, the only consequence for the IAEA is thyroid cancer in children, there are no other health effects after Chernobyl. I take it very calmly now; I have gone through all [attitude] stages before. I'll tell you more. [With thyroid cancer, we were not supported], but the time showed everything. We say now that there are reproductive problems and brain tumors, especially in children. There are problems with cardiovascular system. The time will tell. Gradually, there are more studies coming out, even Russian studies. With cardiovascular system pathologies, they show dose-effect correlations in people living on the affected territories and in liquidators. The time will show everything and teach everybody
>
> In either case, what effect do these IAEA scientists have on us? Do they help us? No. Can they influence us? No. Let them say whatever they want to say. They cannot influence me, they cannot influence the situation itself. They cannot influence what is. The time will tell; it's a good judge.

From the description of the reframing of the international approaches offered in this chapter, it appears that the question is not even whether or not the international organizations can affect research by individual local scientists, but whether they can affect or reinforce particular policies of the state government that would, in turn, affect the Belarusian science (this is the question of the next chapter). The 2003 national report suggests that the Belarusian government (still) does not completely accept the estimations of the Chernobyl consequences by the IAEA and UNSCEAR, but expresses hope in the activities of the Chernobyl Forum: the lack of recognition of the Chernobyl affects has affected international humanitarian assistance to Belarus (Belarus 2003). Individual members of the State Chernobyl Committee, when asked about the persistent international disagreement regarding the Chernobyl effects, replied with irony that, "perhaps these disagreements will be solved at the [Chernobyl Forum] meeting in Vienna," and then, more seriously, claimed to not know: "We are just bureaucrats."

# Chapter 4.

## Science and the State: Setting the Limits of Knowledge

As described in the previous two chapters, in the 1990s, the government of the newly independent Belarus was faced with the burden of coping with Chernobyl consequences, and the official discourse about Chernobyl gradually reframed it as primarily an economic problem, not the least because of the lack of international assistance. International organizations, including the International Atomic Energy Agency and World Health Organization, have been denying presence of any significant radiological consequences of the accident and, starting from early 2000s, they followed the lead of the Belarusian government in emphasizing socio-economic consequences of Chernobyl. This chapter discusses what effects these perspectives of the state government and international agencies had on Belarusian Chernobyl-related research, both directly and indirectly.[84]

The chapter discusses many types of challenges faced by Belarusian Chernobyl research; the result of these problems is production of the lack of experts (or their invisibility), and production of invisibility of radiation-induced health problems and our non-knowledge about them. In the words of Robert Proctor (1995), the general outcome is “social construction of ignorance.”

---

[84] Belarus inherited the Soviet vertical concentration of power, and the state administration has been particularly centralized since election of the first (and as I am writing this, the only) Belarusian president in 1994. Consequently, this analysis refers to “state” as a single and rather coherent actor and not as a set of different agencies with potentially competing interests, as would be more appropriate in other contexts (e.g., in discussing interactions between the state and scientific institutions in the US). All areas of Chernobyl research are coordinated by the State Chernobyl Committee, and are described in five-year State Programs of Overcoming the Consequences of the Catastrophe at the Chernobyl NPP.

Challenges faced by the Belarusian Chernobyl research are, to an extent, shaped by broader political factors. The history of radiological research in Belarus is largely co-extensive with the history of Chernobyl-specific research: most radiological institutions in Belarus have been created after the accident to work on Chernobyl problems. The Belarusian government has played a central role in creating these scientific infrastructures and in shaping their research directions. At the same time, from the perspective of the government, Belarus—a relatively small and economically depressed country—has little incentive to sustaining scientific research for the sake of 'pure science,' especially when this science is not recognized internationally, when it might discourage international assistance rather than encourage it, and when it sustains problematic national visibility of the Chernobyl problem. The 'peripheral' position of Belarusian radiation research with respect to international or Western science means that Belarusian research can hardly present a powerful alternative to the perspective of international nuclear organizations, and that Belarusian research itself is indirectly shaped by their pressures.

These conditions subtending Chernobyl research have led to reframing of research directions and priorities in the late 1990s and early 2000s. 'Economic' reframing in the broader public discourse has been followed by 'ecological' reframing in scientific research: the radiation factor is blended in with other "ecological" factors; the result is research with general, unspecific focus. The (re-)framing of research agendas has coincided with shifts in organization of scientific institutions. These shifts have led to loss of qualified personnel and some subject populations, as well as disruptions in accumulation of data, which in turn produces more theoretically driven (as opposed to empirically driven) research that might be less sensitive to realities of the Chernobyl effects. Problems with Chernobyl classification systems also create areas of non-knowledge. All of these challenges are produced not exclusively by the conditions of "peripheral," state-controlled science, but also, and significantly, they reflect the pervasive and continuous character of the Chernobyl problem and its emergent effects: studying the effects of a "continuing" (Fortun 2001) or "chronic" (Rajan 2002) disaster might require stable, well-funded, and continuous research infrastructures.

This chapter focuses on studies of Chernobyl health effects, but it has be emphasized that this is not the only area of scientific research related to the Chernobyl consequences. Other important areas include estimation, monitoring, and prognosis of the radioecological situation, agricultural production in the contaminated territories, decontamination, and development of radiation safety methods and technologies. I analyze the production of scientific knowledge about health effects based on the assumption that this knowledge is in some way primary with respect to other research areas: that is, it determines the extent to which they are necessary.

## Peripheral Science

This section draws upon Gennady Nesvetailov's analysis of the changes in Belarusian science and technology policies from the Soviet period to mid-1990s—to provide the context for the Belarusian Chernobyl science policies not limited to the national boundaries, but instead affected by the country's positioning internationally, and the external international influences shaping its science policies.

Nesvetailov (1995) uses a general, but powerful concept of "center-periphery"[85] relations to point to how "the international socio-economic system" affects internal processes in "peripheral" countries, referring to Belarus as an example of "periphery" and its science and technology policies as an illustration of these processes. According to Nesvetailov, "centre-periphery" relations refers to "relations between an economically developed, politically strong and culturally sufficient centre, and a periphery weak in all these respects" (1995, 854). These relations are "both politically and economically dependent," but the economic aspect is often dominant. Perhaps the most important aspect of Nesvetailov's description is the argument that science in "the center" and science in the periphery reflect national and international interests differently; it allows to see how technoscientific practices are shaped by international power relations. Nesvetailov argues that there could be more than one center, but "in the center, to a great extent, 'national research' and 'world research' coincide" (1995, 855). In the periphery, "a high research level can be maintained in a small number of carefully selected fields" (856), and—"national" research in those fields is affected by research in the "center". In other words, it is "more prone to the shaping effects of external factors," though different research communities are affected differently and have different dynamics (1995, 855).

The rest of this section will argue that Belarusian research on the Chernobyl consequences has begun in deeply peripheral conditions: radiation research was focused in Moscow. A major effort to establish Chernobyl research infrastructures was undertaken in the late 1980s and early 1990s. The role of the state and a shift from

---

[85] His analysis builds on the work by Alestalo (1991) and Schott (1991).

Soviet to Western orientation in science is the key to understanding problems with production of Chernobyl research described in the following sections of this chapter.

***

In the Soviet science infrastructure, the republics were peripheral to the Moscow center, which had the largest concentration of research institutions and programs, technical equipment and resources, best-qualified scientists, and academic journals (Nesvetailov 1995).[86] The geographic distribution of Soviet nuclear research followed this pattern, with the Ukrainian nuclear research program as the second most developed among the republics (Josephson 1999). Research on radiation health effects was concentrated in Moscow: in the Institute of Biophysics, headed by Academician Leonid A. Ilyin, and Clinic No. 6 (See Petryna 2002). The Byelorussian Republic had no nuclear power plants of its own, and its participation in the Soviet nuclear research program was marginal.[87] As one Chernobyl expert put it, "Belarusians were not in the loop." From today's perspective, the history of research on radiation effects in Belarus largely coincided with the Chernobyl studies, and in its early stages, any radiation research in Belarus was largely peripheral to research in Moscow.[88]

Despite the polarized organization of Soviet science, the Belarusian SSR did have considerable science and technology capacity (Nesvetailov 1995), which, following the

---

[86] Soviet science had "a degree of scientific self-sufficiency and some isolation from world science, although [it]... was on the periphery in intellectual terms to western centres of world science" (Nesvetailov 1995, 858). Within the Soviet Union, there was a period of "political commitment to 'leveling' the science base of the constituent republics," which allowed them "to develop a scientific infrastructure through their own national science academies" (1995, 858). Later, with growing economic problems, resources and personnel concentrated in the centers, especially in Moscow.

[87] One project to construct a mobile nuclear power was headed by Professor Vasilii Nesterenko at the Institute of Nuclear Energy (on the absence of radiation experts in the Republic, see also Belarus 2001). The fact that all research related to radiation was classified added to exclusiveness and geographic concentration of radiation sciences (see chapter 4)

[88] Tamara Belookaya, head of the Belarusian Committee "Children of Chernobyl," personal interview.

accident and contamination of significant parts of the Belarusian territory, served as a foundation for establishing radiation research infrastructures. A relatively small group of experts who led the original efforts came from related fields.[89] In the last years of the Soviet Union, an effort was made to engage various Belarusian institutions in investigating Chernobyl-related topics and to establish new institutions and departments specializing in radiation medicine, radiobiology, and agricultural radiology. By the mid-1990s, the Republic had sufficient personnel and scientific schools working in the field and has achieved scientific results in all key research areas (Belarus 1996) (see tables 4.1 and 4.2 for the description of some of the short- and long-term goals of this research and key scientific institutions engaged in Chernobyl research).

---

[89] For example, Evgenii Konoplya was one of the few researchers in the Belarusian Academy of Sciences with expertise close to the topic of radioactive iodine at the time of the accident: his Doctorate Dissertation was on methods of hormone, chemo- and radio-therapy for breast cancer. Konoplya proposed to Borisevich N.A., the President of the Academy of Sciences, to create the Institute of Radiobiology. The decision was approved by the Belarusian and Soviet Academies of Sciences and the Councils of Ministers; the Institute was established in 1987 with Evgenii Konoplya as its Director.

Evgenii Pavlovich Demidchik started his research on thyroid pathologies in 1972 (Marpes 1996, 104-109), when there was, on average, only one new case of thyroid cancer in children for the whole country per year, and all the cases were sent to Demidchik. After the accident, he conducted tremendously important work on establishing the radiation-induced nature of the rise of thyroid cancer in children (to this day, thyroid gland cancer in children is the only radiation health effect acknowledged by the international nuclear organizations and WHO). Demidchik became the Director of the Belarusian Republican Center for Cancers of the Thyroid Gland and Head of the Department of Oncology, Minsk State Medical Institute.

Vasilii Nesterenko, the chief engineer and director of the Institute of Nuclear Energy of the Academy of Sciences of BSSR, appeared to have quickly realized uniqueness and significance of his position. He tried to warn the Belarusian Republican government about the danger in the first days of the accident—both in personal meetings with the Secretary of the Communist Party the day after the accident, when the information was kept secret from the public, and later through letters with policy suggestions. Nesterenko was part of the Belarusian Committee of experts formed in early May of 1986 to assess the situation; his Institute conducted analysis of soil samples and created first maps of the contamination. Later, Nesterenko was released of his duties as a director of the Institute because the "alarmist" letters that he wrote to the Soviet Republican government (Nesterenko's work at the Independent Institute for Radiation Safety "Belrad," which he created subsequently, is described in chapter 5).

**Table 4.1** Selected areas of short- and long-term Chernobyl research

Research on radioactive contamination of ecological systems and life conditions of the population:

- identification of radioactive contamination and radionuclide behavior in different environments (various soil types, plants, water, and air);
- monitoring and forecast of radioactive contamination;
- research on genetic, physiological, and biochemical effects of radioactive contamination of the environment.

Radiometric and dosimetric control:

- development of methods and equipment for radiation control and radiation protection;
- prognosis of doses of external irradiation and determination of diet components contributing to internal doses.

Research on radiation health effects and preventative care for the affected populations:

- epidemiological studies of morbidity of the population;
- research on radiation effects on the functional systems of the organism (endocrine, immune, cardiovascular, and reproductive systems);
- research on combined effects of radiation and non-radiation factors;
- development of diagnostic, treatment, and disease prevention methods, and evaluation of protection countermeasures (including health recuperation in sanatoria and resorts).

Decontamination and rehabilitation of the contaminated territories:

- techniques of reduction of the radioactive contamination;
- techniques of agricultural production and rational use of resources on the contaminated territories.
- search for natural or artificial compounds with radio-protective properties.

Socio-economic development of affected areas.

Sources: Matsko and Imanaka 1998; Belarus 2001.

**Table 4.2** Chernobyl Research Institutions in the late 1990s

*Key research institutes:*
- Institute of Radiobiology of the National Academy of Science of Belarus, established in 1987
- Research Institute of Radiation Medicine[90] (with branches in Gomel, Mogilev, and Vitebsk), established in 1987
- Belarusian Research Institute of Agricultural Radiology[91] (Gomel)
- Institute of Radioecological Problems of the National Academy of Science of Belarus, established in 1991 (based on part of the former Institute of Nuclear Energy of the Academy of Science)

*Selected other research institutes with departments or laboratories conducting Chernobyl-related research:*
- The Institute of Nuclear Power Engineering of the Academy of Science
Belarusian State University
- The Belarusian Scientific Research Institute of Hematology and Blood Transfusion
- The Institute of Oncology and Medical Radiology
- Belarus Research Institute of Soil Science and Agrochemistry
- Belarus Center of Medical Technologies, Information, Direction and Economy of Public Health
- Institute for Genetics and Cytology, Academy of Sciences of Belarus,
- Institute of Oncology and Medical Radiology
and others

*Institutes and departments providing expert training:*
Sakharov International Institute of Radioecology,[92] established in 1992
Department of Ecology at the Belarusian State Polytechnics Academy
Department of Radiation Medicine and Ecology at the Minsk State Medical Institute

Sources: Belarus 2001; Matsko and Imanaka 1998
Note: By 2003, the leading institutes were relocated from Minsk to Gomel.

The circumstances of this period and the transformations of the broader Belarusian science and technology policies are the focus of Nesvetailov's 1995 study (mentioned above). Following the collapse of the Soviet Union (end of 1991), the already difficult economic conditions in the country had worsened dramatically. Science was underfunded and lacked technological equipment; due to deeply inadequate wages, the number of employees in science and technology areas decreased by half in the period

[90] Later named as Research Clinical Institute of Radiation Medicine and Endocrinology of the Ministry of Health of the Republic of Belarus.
[91] Later named as Republic Scientific and Research Unitary Enterprise “Institute of Radiology” under the State Chernobyl Committee.
[92] Later renamed as Sakharov International Ecological University.

1990-1994 (Nesvetailov 1995). Incidentally, according to other sources, the majority of Chernobyl research teams during this period were not paid salaries, but continued working on their studies (Belarus 1996, 77; Matsko and Imanaka 1998). Nesvetailov observes, for the same period, there was "strong evidence of a growing Western orientation in Belarusian science-at the level of the state, Academy [of Sciences], and institutes" (1995, 868).

According to Nesvetailov, the government assumed more active control over science and technology development following the 1994 election of President Alexandr Lukashenko, adoption of the new Constitution, and the reform of executive power. Government control was deemed necessary for the long-term progress of science; spending for science increased, and government science and technology policies aspired for Belarusian science to contribute to world science in selected areas. Yet, the essential conflict in this government management of science—the issue of peripheral countries—is the question of the technoscientific research amid limited resources. On the one hand, Nesvetailov mentions that mitigating Chernobyl consequences is “a major priority over which the country has had no choice” (1995, 871, fn. 49). On the other hand, he writes that it appears "inevitable” that the focus in science and technology policies will be on “more and more 'applied'” research, which prioritizes “short-term objectives.” This poses a question of the kind of Chernobyl research developed in Belarus, the role of the state in shaping this research, and the role of external factors, such as international Chernobyl science, in shaping the science policies of the state and the research approaches of the Belarusian scientists.

In terms of the government management of science, there are several particular challenges for the state management of Chernobyl research. The problem of Chernobyl consequences is an ‘emerging’ problem of a “chronic disaster” (Rajan 2002): it is not given in its entirety at any given moment; rather the scope of the problem emerges gradually. In other words, Chernobyl is a "continuing disaster" (Fortun 2001), which might require consistent long-term effort. Additionally, the conditions of uncertainty make estimating the scope of the needed scientific effort more difficult; this is particularly important since there is no tradition of research on radiation health effects in the country predating Chernobyl. Arguably, this makes Chernobyl research particularly vulnerable to structural changes initiated by the state government because it has fewer entrenched practices, accumulated institutional resources, and is more likely to be interpreted as not ‘fundamental,’ but politically motivated. Finally, the post-Soviet administration of science in Belarus resembles the Soviet system: directors of state institutes and universities are appointed by the government (or the president), which increases state control over the priorities and directions of research.[93]

The next sections demonstrate how state management of the Chernobyl science has changed in the second half of the 1990s and early 2000s: the state conception of Chernobyl research priorities has been affected by the rhetoric and policies of

---

[93] For example, one researcher expresses her distrust for the leadership of the new Center for Radiation Medicine in Gomel: "Kapitonova [the director] was never into Chernobyl problems. She is from Grodno [‘clean’ area] herself, and not much of a scientist either. Not respected much as a scientist. She is probably somebody's relative." Appointed leadership provides a vehicle of steering the institute politics in accordance to the current government policies. Change of a rector of the Sakharov Ecological Institute has been described by the Institute’s faculty and former students as the change in the international cooperation of the Institute: the new rector, transferred from the Belarusian State University, cut the international ties fostered by his predecessor.

international organizations representing the international nuclear expertise. [94] The rest of the chapter focuses on the specific policies and approaches that resulted in "social construction of ignorance" in the case of health effects of Chernobyl radiation.

## Reframing research: the disappearing radiation factor

This section discusses reframing of Chernobyl research, first, based on the example of official national reports of Chernobyl consequences, and then with respect to implications that reframing of Chernobyl research questions has had for research practices and outcomes. Reframing will refer to the de-emphasizing of the radiation factor and instead phrasing Chernobyl questions as *ecological* issues; such a broad and unspecific focus makes the radiation factor invisible in terms of identifying directions for research, research topics and questions, and presentations of research conclusions. In the national reports discussed below, the role of radiation is gradually de-emphasized through how the results are interpreted, what counter-arguments are acknowledged as valid, and how the impact of arguments is modified with qualifications and anticipated objections. Reframing coincided with changes in government conceptions of the perspectives of international organizations and the international role of Chernobyl science.

[94] These external influences on the national science and technology policies are certainly not unique to Belarus. Kim Fortun (2001) provides a powerful description of the national-international levels of the Bhopal disaster. In the description of the role of the government of India, Fortun places it within the broader context of the international order and “the difficulties and contradictions Third World governments face within contemporary culture and political economy” (2001, 144). In description of the reactions to the settlement of the Bhopal case, Fortun writes: “Since independence, fear of exploitation had shaped India’s engagement with the international order. By the 1990s, the greatest fear was of *exclusion*” (2001, 146-147).

**When Radiation Disappears: National Reports**

Reports from different years are consistent in emphasizing that Chernobyl consequences far exceed just radiological effects; they are complex, multi-layered and include socio-economic consequences. The reports appeal for international assistance and each includes a chapter on international cooperation, but the later reports are also more reflective of the international disagreements on Chernobyl data, and of how these disagreements affect international assistance. The 1996 report interprets the data itself as significant; its significance rests on the continuing international use of nuclear materials and the fact that existing experience was proven inadequate in mitigating Chernobyl consequences. According to that report, the International Atomic Energy Agency (IAEA), based on its role, should express more interest in the data and in mitigating the consequences. Later reports also include (mildly) critical comments regarding international organizations' view of the lack of radiological consequences, but they do not appeal to the inherent value and uniqueness of the Chernobyl experience and knowledge. The 2001 report emphasizes the Belarusian willingness to cooperate "in every possible way" with the UN organizations and protests against narrowing the consequences as just radiological.[95] The 2003 report marks the new stage of the international cooperation; establishment of the Chernobyl Forum and the International Chernobyl Research and Information Network, hoping they will show "proof" of the effects and help overcome the disagreements in estimating the scope and character of

---

[95] The 2001 National Report argues that, "International reports frequently consider the Chernobyl catastrophe only from the point of view of the radiation factor... The Chernobyl problem is much more complicated. It is impossible to underestimate its economic, social and humanitarian aspects, especially at the background of difficulties of Belarus' transition to the market economy" (Belarus 2001, 107).

consequences, since these disagreements continue to cause "difficulties in attracting international assistance" (2003, 48).

The later reports adopt a similar approach to discussing specifically *health* consequences of the accident; the reports emphasize the complex character of factors affecting people's health. The 2001 and 2003 reports describe significant increases in particular diseases among groups of the affected populations; the causes are said to include both radiation and non-radiation factors. The new formula is that "Chernobyl factors" equal radiation plus non-radiation factors, where non-radiation factors refer to "social, economic factors; stress; risk perception" (Belarus 2001, 23). Descriptions of "non-radiation factors" are presented similarly to the international reports (see chapter 3): the mechanisms of their influence are not explained. Putting radiation and non-radiation factors together into a new entity labeled "Chernobyl factors" allows the national reports to insist that populations have indeed been affected and that there have been consequences, even when the IAEA and WHO experts doubt the effects of radiation. The total effects of radiation and non-radiation factors, none of them appears to be studied in-depth and the role of the radiation factor is increasingly questioned and downplayed.

The question of "the radiation factor" versus "non-radiation factors" is transformed in similar ways for different groups of diseases: cancers, hereditary defects, and non-cancer diseases. Attributions of the causes of the increased rates and different patterns of non-cancer morbidity to the radiation factor are particularly uncertain since only cancer diseases are officially recognized as linked to the effects of the radiation factor. The total effects of radiation and non-radiation factors are not described as 'synergetic effects,' but rather an unspecific sum of factors. The changes in interpretation can be illustrated by comparing the reports from 1996, 2001, and 2003.

The 1996 report states that "the structure of morbidity" on the affected areas has changed,[96] notes an increase in particular "oncological diseases," and links the increase in diseases on the highly contaminated territories to the larger radiation doses.[97] The section on hereditary defects explicitly refers to the increase in congenital defects in children linking them to the radiation factor, the results have been confirmed by cytogenetic studies.[98] In contrast, the 2001 report is much more cautious about the rise of non-cancer diseases. On the one hand, it states that the role of the radiation factor is not clear (it could be due to increased screening), and "more data is needed." On the other hand, in conclusion, the report notes that, though traditionally, cancers were considered the main radiation health effect, more data has appeared in the last years indicating "the radiation origin" of a range of non-cancer diseases and, again, lists the most prevalent types of non-cancer morbidity among all groups of exposed populations.[99] The 2003 report notes the same rise in the same kinds of non-cancer diseases and explains them as a result of radiation and non-radiation factors; the report details which hereditary defects are on the rise, but then states that it could be an effect of non-radiation factors (such as diet). In conclusion, the report argues that:

---

[96] The report observes significant growth in the diseases of "organs of digestion, blood circulation system, nervous system, organs of respiration and endocrine system" (1996, 47).
[97] The noted increases are in lung, breast, bladder, and kidney cancers (1996, 53).
[98] The section is written by Gennady Lasjuk, whose studies on hereditary defects are often referred to by the Belarusian Chernobyl experts.
[99] The report argues that: "Numerous data indicate serious health problems in liquidators, evacuated persons and the population living on the contaminated areas. In this case the growth of the morbidity rate is registered practically for all the main classes of illness of the systems of blood circulation, respiration, digestion, the endocrine, nervous, genitourinary and other systems" (2001, 106).

> Medical consequences of the Chernobyl catastrophe are not limited to the radiation factor. .... inadequate perception of the radiation risks which leads to persistent psychological discomfort... Complex influence of radiation and non-radiation factors of the Chernobyl catastrophe leads to ... non-oncological morbidity" (2003, 51).

Similarly, the 2006 Chernobyl conference report on the Presidential website[100] explicitly states that there is a rise in non-cancerous morbidity, but that "it is not related to the radiation factor under the current state of knowledge."

To summarize the argument so far, the national reports appear invested in demonstrated Chernobyl-related health problems, but attribution of these health effects to the radiation factor becomes increasingly cautious and uncertain. As will be demonstrated below, this is not a question of correcting rash statements by acknowledging scientific criticism by the international nuclear organizations regarding the role of the radiation factor. Rather the research questions and priorities are reframed: there is no attempt to specify the role of the radiation factor; the emphasis shifts, not to studies of the synergetic effects of the radiation factor and other factors, but to nondescript "ecological" factors responsible for the health problems of the Chernobyl-affected populations. The next section describes the disappearance of the radiation factor in Chernobyl studies as both the result of conscious government policy and a consequence of the scientists "taking cues" (Cresnon 1979).

---

[100] The 2006 Chernobyl conference report was published on the website of the President of the Republic of Belarus, Alexandr Lukashenko (http://www.president.gov.by/data/press28694.pdf).

### "Nothing Concrete": Losing the Radiation Factor in the Practice of Scientific Research

The effects of the 'ecological' reframing are described by Galina Bandarzhevskaya who conducted research on radiation-induced health effects together with Urii Bandarzhevsky.[101] According to Bandarzhevskaya, the Belarusian science "is not connecting" health effects—morbidity in highly contaminated areas—to the radiation factor. Radiation is only associated with thyroid cancers and no other risks; research questions are asked about unspecific "ecological" factors. As a result, "nothing concrete" is published on Chernobyl effects in the medical journals: "Effects of the radiation factor are described in passing, without conviction."

One of the leading scientists working on Chernobyl observes the same tendency of explaining health effects in the most affected populations with "ecological" factors. According to him, the radiation factor is considered to a lesser degree, whereas "such synergetic action [of different factors together] is too serious. There is not just addition of effects, but aggravation of the effects (*usilenie*) in this case." The 'ecological' approach blends the factors together, producing not a better understanding of the complex reality of effects, but *invisibility of the radiation factor*. The nature of the relationship between "ecological" factors is not described; research is limited to describing tendencies, but not causes. Bandarzhevskaya summarizes the situation as follows:

> The money is spent, the programs are completed, but conclusions just prove what they have to prove. The practitioners, physicians, say that, "We see unusual things but studying them is the prerogative of scientists." And scientists say, "We've looked, but it is hard to single out the radiation factor here."

---

[101] Professor Bandarzhevsky's research and his imprisonment are a separate chapter in Chernobyl research in Belarus, and it is discussed below. Bandarzhevsky is a former rector of the Gomel Medical Institute and is perhaps the most well-known and influential of the Belarusian scientists working on Chernobyl issues.

Bandarzhevskaya connects this practice of "not singling out" the radiation factor to the fear of being snubbed by the IAEA. According to her, Belarusian scientists need international cooperation: "IAEA is a powerful organization against weak Belarusian scientists. Belarusian scientists won't be able to do much without the help of international researchers."

The solution Bandarzhevskaya suggests is international programs for basic science research on effects of low-dose exposures, especially internal exposure. According to her, this research would "collect proofs" and provide the grounds for organizing preventative measures.[102] The radiation factor would be treated as a risk factor in public health issues, in the same ways as, for example, smoking or obesity: "When a person is treated, radiation exposure should not be forgotten. Patients, for example, can be checked for their internal accumulation of radiocesium with whole body radiation counters." [103]

Urii Bandarzhevsky attempted to research the radiation factor, but to quote another researcher, "his voice was heard only by prosecution." Bandarzhevsky, a former Head of the Gomel Institute of Medicine, led a group of researchers, recognized as "the Gomel School," in studies of the effects of internal accumulations of radionuclides. A pathologist by training, Bandarzhevsky conducted, for example, autopsies of newborns who died of causes unrelated to radiation. He measured accumulations of radio-cesium

[102] According to Bandarzhevskaya, current preventative measures are hampered by the lack of scientific results or adequate government policies: "but the person's life is not endless."
[103] Bandarzhevskaya's view of the radiation factor is different from that advocated by the IAEA experts who make no distinction between internal and external exposures.

in their heart muscles (his research demonstrated that Cs-137 accumulates in vital organs) and showed dose-effect dependence between accumulations and functional problems of the heart; with chronic exposure, functional problems become irreversible (Bandarzhevsky 2000, 2001). Bandarzhevsky was accused on bribery charges and imprisoned in 1999; his sentence was protested by a number of organizations, including Amnesty International, which believed that he was imprisoned for his critique of the Chernobyl policies of the Belarusian government. Bandarzhevsky received the Citizen of the World honorary passport from the European Union; he was released in 2005.

Reframing of research agendas and questions takes place in two ways: through government restructuring, and renaming of institutions and by way of "scientists taking cues," without explicit directives. The next section of this chapter will discuss the effects of relocation of all the major Chernobyl-related research institutions closer to Gomel and to the affected areas (most of them used to be in the capital, Minsk), but an obvious sign of the government agenda for Chernobyl research in the late 1990s and early 2000s is renaming of the institutions. For example, in 1999, Sakharov International College Institute of *Radioecology*, a leading college preparing radiologists and radiobiologists, was renamed Sakharov *Ecological* University.[104] Its faculty were asked to exclude the word "radiation" from their topics (during routine research topic approval processes); one faculty member describes the administrative policies at the University: "One can only

[104] The Institute was first established in 1992 as Sakharov International College of Radioecology, on the basis of the Belarusian State University in 1992. In 1994, it became an independent institute with two departments: radioecology, and radiation and ecological medicine" (Belarus 2001, 97). The mission of the institute used to explicitly address Chernobyl-related problems: preparing experts for prevention and mitigation of radiation accidents, dissemination of radiation safety knowledge, research on post-Chernobyl problems, and establishment of international radioecological cooperation.

study radiation in Gomel now, where there is a special center for that. Here, one can study chemical or physical processes, as long as they are not radiological."

Another example of renaming and reshaping research is the Scientific and Research Institute of *Radiation Medicine* in Minsk was renamed as the Scientific and Research Clinical Institute for *Radiation Medicine and Endocrinology* (it was later moved to Gomel). According to one researcher, who links these changes to thyroid cancer being the only health consequence clearly linked to Chernobyl radiation: "All radiation medicine has become about endocrinology. I wonder if it is going to be just endocrinology soon."

Scientists also "take cues" from the administrative discourse; explicit directives to reframe research are not always necessary. [105] Following Bandarzhevsky's imprisonment, the Gomel School collapsed; according to Galina Bandarzhevskaya, "there are studies, but no enthusiasm." There is explicit awareness among scientists that the government is no longer investing into Chernobyl research. One researcher observed:

> I have heard [the Head of the State Committee on Chernobyl] on TV saying that we are a poor country so the programs are going to fold. ... I would never have believed that we would stop working [on Chernobyl] so soon. We thought that we would have enough Chernobyl problems to last us for a hundred years.

When asked if some particularly wide-spread or otherwise extraordinary radiation health effects would still "come out," she replied, "Depends on who's in charge, doesn't it?"

---

[105] Cresnon (1979) described the "non-politics of air pollution" in the 1970s in the US; he argued that perception of the position of those in power is determining influence, no actual threats or manipulations are necessary.

## Restructuring Chernobyl Research

Framing of scientific agendas and directions for research (discussed in the previous section) is related to a broader, and perhaps more long-term, question of managing institutional organization of science. Structural changes and classificatory issues described below become problematic partly due to the "continuous" character of the Chernobyl disaster and, hence, the need for sustained and continuous data collection. With loss of data continuity, empiricism is given up in favor of theoretical approaches. Focusing on the late 1990s-early 2000s, this section discusses relocation of the key research institutions and other structural challenges to Chernobyl science, and the implications of the resulting shift from empirically-based research to more theoretical calculations. Classification problems described in this section lead to similar loss of empirical data. As a result, in the words of one Chernobyl expert, "there are no statistics, only anecdotal cases" (the full quote is provided below).

### Away from Empirical Data

In the early 2000s, the three main Chernobyl research institutions—Institute of Radiology, State Scientific-Applied Center of Radiation Medicine, and Institute of Radiobiology—were relocated from Minsk to Gomel; the relocations were complete by 2003. This was not the first transformation of these research institutions. In the mid-1990s, for example, the Center for Radiation Medicine in Minsk,[106] had an out-patient center in downtown Minsk and a hospital located on the outskirts of Minsk, in

[106] Originally, it was part of the Institute for Radiation Medicine, but later became an independent establishment.

Aksakovschina. The downtown location was close to the railway station, which made it convenient for patients from outside of Minsk. It also, incidentally, neighbored the President Administration hospital. In the late 1990s, the building of the downtown out-patient center was said to be in “unsafe condition,” and the center was relocated further away from the downtown and the railway station. According to a former physician from the Center, “it was all done to fault Chernobyl science. There was no renovation in the original building after we were moved from there."

Following the relocation of Chernobyl science to Gomel, the facilities in Minsk have no longer been observing and treating liquidators (Chernobyl clean-up workers) or populations from the affected territories; Aksakovschina now specializes in cardiovascular problems and early rehabilitation. According to a physician I spoke with, "the system has been destroyed." While most Chernobyl researchers acknowledge that the Center in Gomel is very well equipped (and the very fact of investing into such a sophisticated and technically-equipped center reflects at least earlier government commitment to Chernobyl science), the changes have also led to loss of personnel, disruption of data collection and patient observation, and, subsequently, changes in methodological approaches.

*Personnel changes.* Mostly two groups of researchers were willing to relocate from Minsk, the capital, to Gomel: young scientists and faculty nearing retirement age, "who might not have been able to find work elsewhere."[107] Other experienced personnel stayed in Minsk and are no longer conducting Chernobyl-related research or patient observation. According to one scientist who stayed in Minsk, the decisions to relocate

[107] Former physician from the Center for Radiation Medicine, Minsk, personal interview.

"might have been adopted without realizing what they would mean. There are big names in Gomel: Konoplya, Kapitonova [the head of the Center for Radiation Medicine in Gomel]... but losing all that faculty is a loss of knowledge."

According to the head of one of Chernobyl research institutions, 75 out of 165 faculty of his Institute relocated to Gomel:

> We have to hire new faculty, they have to learn the research methods, it's a complicated and long process... Everything was set here, we had well-qualified faculty [*podgotovlennye kadry*]. Everything has been smoothed out during these years, from 1987 until 2003, about fifteen years, not full seventeen years, since it took time to organize everything in 1987 as well. Much has to be recovered now. We have new, young faculty, they have to get trained until they enter science (*voidut v nauku*).

But he remains optimistic, "We already have first dissertations and first conference presentations, so some things are happening faster than I had expected. And, overall, what we have is a serious research complex."

*Changes in the observed populations.* The concentration of Chernobyl science in Gomel implies changes to the observed populations and loss of certain groups of the affected populations that have been observed in Minsk.[108] Minsk-based evacuees and resettlers—Marples (1999) estimates this group at 25,000—are no longer observed separately from the rest of the population; they are treated in their local health centers (*poliklinika*), and data on their health status is not collected or sent to Gomel.[109]

---

[108] As of 2004, there was still a branch of the Center for Radiation Medicine in Mogilev, which is important since "there are people there [in Mogilev Region] who lived on territories of 200 Ci/km² for several years" (Physician, former employee of the Center for Radiation Medicine, personal interview).

[109] Many of those who were evacuated in 1986 live in Minsk, Gomel, and Smorgon. In Minsk, for example, the building on Esenina 137 is the multi-store housing building almost entirely occupied by the evacuees; many live in Malinovka area of Minsk. See Marples (1999) for a more detailed description of evacuations and the population of evacuees in Minsk.

Another population group that is no longer observed is liquidators. According to a physician from the former Center for Radiation Medicine in Minsk, liquidators visited their Center "so that they could receive treatment at Aksakovschina. Otherwise, it was difficult to get into a hospital with a chronic condition and you had be buying your own medicine. Liquidators and evacuated populations could get subsidized medicines [15% discount]." [110] Without these incentives, even though liquidators could still be treated at the outpatient center in 2004, few of them went there; it was, in the words of the same physician, "just a serious time commitment." She also expressed doubt that liquidators would be traveling to Gomel without having any real incentives to go there.

*Changes to data collection and research methods.* The database at the former Center for Radiation Medicine in Minsk is no longer maintained or used. According to physicians of the Center, the database included data on every child observed since the establishment of the Center, though it has not been added to since the decision to relocate. The database was not moved to Gomel, and, according to one scientist, "nobody has asked for it, nobody needs it in Gomel.... All the statistics used to come here; what kind of information comes there, is difficult to tell. There is no information now."

*Other structural challenges: "bureaucratic fiction" of clinical examinations* In the early 1990s especially, part of the screening of the affected populations was done by teams of physicians from the Center for Radiation Medicine who traveled there from Minsk; this screening by designated teams of physicians was soon discontinued due to lack of funding (Marples 1996). Considering the many problems with the current health

[110] Later, Aksakovschina was "taken away" and the Ministry of Health issued a resolution for physicians to prescribe only Belarusian-made drugs.

care system, observation or collecting data on the affected populations—when it is done in out-patient centers (*poliklinika*), and not in hospitals or by designated teams of physicians—is a "bureaucratic fiction."[111] A physician from the former Center for Radiation Medicine describes what this examination might mean:

> I called a local out-patient center [*poliklinika*], inviting children to come and be examined here [former Center for Radiation Medicine], since it is still free and we don't have much of a workload. They tell me, "What are you talking about? We have submitted our annual data reports for clinical examinations [dispanserizaciya] a few months ago." I ask them, "Have you examined everybody already?" They laughed, 'We've examined some people and wrote in some more people. The staff there [in local out-patient centers, poliklinikas] is overloaded dealing with acute problems.

Physicians and scientists quoted above generally agree that, "they will see few patients [at the Center for Radiation Medicine] in Gomel; the rest are going to be coping at home however they can"—in the continuing absence of adequate screening programs for the affected populations or reliable general health care.

At the same time, problems are discovered for the populations that *are* still observed. According to a colleague of Professor E. Demidchik, the key Belarusian researcher on the thyroid gland pathologies, there used to be a screening program for thyroid problems, but it was also cut due to the lack of funding. As a result, thyroid problems are discovered in the populations that are tested, i.e., pregnant women and young medical students have better chances for early diagnostics:

> Those who were small children at the time of the accident are particularly at risk for thyroid cancer; they are now young people aged 20-25. They come to us as students and find out their own thyroid problems. And many young

---

[111] For residents of the contaminated areas, clinical examinations twice a year at local health centers have been replaced with annual comprehensive exams (with groups "at risk" examined twice a year). For examination, residents can go to their local medical establishment or their regional center. For extensive discussion of the inadequacies of the general health care system for the affected populations and especially in the rural areas, see Marples (1996). The problem with health care are also well-documented in all reports on Chernobyl, including those by UNDP and UNICEF and the World Bank.

> women, since all pregnant women get tested, and their thyroids are checked. Some of them are pretty far along. We currently have thirty such patients. We have made about 25-26 surgeries after 16 weeks of pregnancy... If you don't do a surgery, the cancer can spread.

When the personnel changes, observed populations shrink, and previously-collected empirical data about doses and effects is no longer available, the research turns to more theoretically-based deductions, which, in turn, further obscures rather than illuminates peculiarities of the local radiological conditions and radiation health effects (see chapter 5).

## Classification Challenges

Gathering data on Chernobyl health effects critically relies on adequate categorization of relevant diseases and affected population groups, and on adherence to these categories. The brief description below points to at least three ways in which the Belarusian classifications of radiation-related effects and affected population groups might be problematic. The classification problems described below add to general issues of completeness in the Chernobyl registers (and, possibly, selectiveness of the registers): for example, according to one well-established Belarusian scientist, 300,000 children were born in 1986-87 and only 2,500 are in the register. Similarly, the Chernobyl register does not include all the liquidators, some of whom did not want to be included (Marples 1999).[112]

---

[112] While registers are not 'mirrors of reality,' blanket invalidation of the Belarusian data on the basis of incompleteness of registers erases and makes invisible much more than data based on incomplete registers would obscure.

*Discontinuous categories.* Another example of a categorization problem which makes some Chernobyl health effects less visible is lack of a separate medical category for those who were exposed to the highest post-accident doses as children. Children are particularly vulnerable to radiation exposures, and those who were children at the time of the accident are more at risk of developing radiation-induced effects (e.g., the rise in the incidence of thyroid gland cancers was particularly high for this group). A researcher working with Belarusian Chernobyl registers pointed out to me that—unlike Japanese Life Span studies for the survivors of Hiroshima and Nagasaki bombings—there is no separate category "Children of Chernobyl" in Belarus. A "Children of Chernobyl" category would give a separate status (and make statistically more visible) the group of adults who were children at the time of the accident but are no longer aged 0-14, i.e., are no longer "children" according to the general classification. Without this category, would-be "Children of Chernobyl" are "dissolved" in the larger pool of potentially less affected adults. The phrase itself, "Children of Chernobyl," is used commonly in the media and by humanitarian organizations to refer to those who are children now (unlike the earlier generation, they are exposed to significantly lower doses).

*Over-restrictive categories.* Significantly restricting categories increases what is not visible and not recognized as meaningful data (Bowker and Star 1999). The most graphic examples of this "classical" way of "containing" the Chernobyl accident are the Soviet ways of categorizing (see chapter 5). The Belarusian Committee on Connection with Radiation Exposure, which oversees individual claims regarding the "radiation tie" of their health effects also follows notoriously stringent definitions of which diseases are radiation-induced. Indeed, two leading Chernobyl experts, Vasilii Nesterenko and Ivan

Nikitchenko, both had to struggle to get their health problems recognized as related to their extensive past exposures (Nikitchenko 1999; Nesterenko, personal interview).

*Non-uniform categories.* When categories are not consistent and uniform, data is likely to be lost "in-between" the categories; making sure that categories are consistent and uniform is work that has to be done in actual practice of using categories (Bowker and Star 1999; see also chapter 5 for the discussion of aligning categories). One physician and member of a Chernobyl civic organization argues that:

> There are no good statistics; everybody is doing them their own way. I was looking through reports in a hospital in Gomel Region. I looked under "hereditary development defects" (*poroki razvitiya*) and it listed six cases. I looked under "hereditary anomalies of development" (*anomalii razvitiya*), which is the same thing, and it listed thirty cases.

She then takes the argument about the problems of epidemiological analysis of Chernobyl health effects even further:

> Statistics are corruptible; they can be turned whichever way, and it completely depends on who is doing it. Say, there is a girl, she was twelve at the time of the accident. She grows up and it turns out she has endocrine problems. Later she has a still birth and then two miscarriages. Then finally she gives birth a baby girl who has health problems. But who would ever count her or any of her problems if, for example, she lives in Minsk? Where would she be counted? *There are no statistics, only anecdotal cases.* That's the sense of the games with statistics. When we talk to people here, they tell us, "we are dying off." That one lost her brother, that one has a disabled husband, but nobody can do anything (emphasis added).

This expert is also aware that political and socio-economic conditions affect what becomes visible and what can be counted. In several examples from Russian colleagues, she discusses, for example, the job and social security conditions in a Russian town with military uranium production where jobs have multiple benefits and "becoming sick" means losing these benefits and having no security. Another example describes "erasing" visibility of genetic effects when there is no orphanage in a town like this: children with genetic problems are more likely to be put in orphanages, and placing them in other orphanages throughout the area would help "erase the numbers."

***

Research practices and outcomes depend on framing of research, i.e., on how the questions are asked and what the priorities for scientific research are, and, subsequently, on the political circumstances of research. One simple way to make the radiation factor invisible is by “blending” it indiscriminately with other factors; we have seen similar discursive strategies in the international reports on Chernobyl. In each particular case, this “blending” need not be done consciously; researchers might simply be following the topics and questions propagated by the government and international nuclear experts.

The Belarusian conditions of research are unique in that research agendas and research questions reflect, to a degree, “external” influences, but the phenomenon of the invisibility of the radiation factor and production of non-knowledge are certainly not unique to it. Robert Proctor (1995) describes “social construction of ignorance” for Western contexts: how politics shapes what is known and not known about cancer, including ignorance about the effects of the radiation factor. Unlike many other hazards, increased levels of radiation *are* easily detectable with scientific means; as nuclear critic John Gofman (1990) points out for Western contexts, since the field of radiation research has been particularly well funded and there is more data available, compared to other toxins. Gofman is particularly concerned with bias in nuclear research and practices of mishandling data. Writing in 1990, he argues that production of non-knowledge in this field might be indicative of what awaits other fields of toxicology: “It is possible to mishandle the evidence concerning radiation injury in such a manner that the next 100 years of human history will be characterized by total medical ‘unknowledge’ in this field, instead of knowledge” (Gofman 1990, forward-2).

This raises the question of what kinds of effects and under what circumstances can become “knowable.” Under what conditions (features of the diseases and its incidence, structural conditions of research, methodological approaches, and, perhaps, political savvy of researchers) can make the link between particular effects and the radiation factor be made visible?

## Missing Experts and the Radiation Factor

There are theoretical and applied areas where the Belarusian experts claim to have accumulated unique experience or what in chapter 3 has been referred to as “intimate knowledge.” Not surprisingly, the most clear examples come from the area of thyroid cancer research. Professor Demidchik's colleague highlights the unique Belarusian experience and knowledge by contrasting cases of children who have been treated in Belarus versus those whose parents took them for treatment in the US, Germany, or Sweden, motivated by their belief in the power of Western medicine and medical technologies. The cases show that, “Western doctors simply don't know these patients,” i.e., projected courses of their illness, risks, and their optimal treatment. Even specific issues of thyroid cancer and pregnancy—"these types of problems are a rarity there [in the West]. For us, it's routine." Cases of children who underwent treatment abroad compare poorly to patients treated in Belarus:

> One case is the mother who arranged for the child to be operated on and treated in Germany. They even removed his thymus and did not give him the right treatment. When they were in Aksakovshchina, the mother asked me why her son is doing so badly compared to other children with the same original problems. I asked her, "Why did you take him to have his surgery in Germany?"

These examples describe the experience with thyroid cancer in children, which, unlike other areas has been both recognized as related to Chernobyl radiation and is markedly specific to Chernobyl. Generally, however, all of the factors described above—reframing, and structural and classification challenges—have consequences for both the kinds of knowledge produced and the state of Chernobyl-related expertise in Belarus, i.e., who the experts are and what their areas of expertise are. These challenges for Chernobyl science are partially the result of power-imbalanced international conditions and the pressure from the international nuclear community. The effects of this pressure are observable in changes of how the government and scientific institutions frame their Chernobyl research questions and agendas: there has been ideological pressure to shape research as not explicitly focused on radiological effects, but instead broadened to include unspecific "ecological" problems.

The international and national political circumstances of Chernobyl research create a paradoxical condition in Belarus: though there are research institutions and research projects underway, there appear to be very few publicly and professionally visible, publishing experts on Chernobyl.[113] When Urii Bandarzhevsky was asked a year after his release from prison, who are the leading Chernobyl researchers in Belarus now, answered, "I would like to know that myself." Some researchers I spoke with tried to keep a "low profile"; others, while working in Chernobyl research institutions, claimed to be "not competent." Top officials at the Ministry of Health advised me to talk to the director of the international CORE Programme, "They might be able to help you better," again claiming lack of relevant expertise.

The radiation factor also becomes less visible; experts do not distinguish it from other negative influences on individual health, thus disregarding its particular effects and mechanisms. Even radiation-induced thyroid pathologies can be described as a consequence of iodine deficiency in Southern regions of Belarus (though clearly iodine deficiency by itself would not be sufficient for the rise of thyroid cancer). Depending on personal views, these experts either claim that "nothing has been found" and, for example, "radiation effects on the cardiovascular system seems to be too far-fetched; there are other factors there," or they describe *anecdotal* evidence to prove the reality "Chernobyl effects." For example, the story of a known female surgeon who worked in Gomel Region and later was diagnosed with a particular type of cancer was told to me on two separate occasions by different experts describing the reality of the Chernobyl problem.

Invisibility of both experts and radiation effects is further exacerbated by the relative "information vacuum" and lack of spaces devoted to scientific discussion of

---

[113] I have encountered similar reactions among the experts from the Sakharov International Ecological University, the former Center for Radiation Medicine, the State Pediatric Center for Oncology, or even the science department of the Ministry of Health.

Chernobyl effects.  There is only one annual publication devoted to Chernobyl, and several researchers commented on the lack of Chernobyl studies in regular medical journals.[114]

One scientist, keeping a very low profile, said: "It is all so clear here, all the consequences are very clear, but it is too bad that the science is so political." Another researcher summarizes, "There is good, fundamental science, but everybody is very cautious about it, it is received very carefully." Yet another physician and member of a Chernobyl NGO, when asked whether she gets a feeling of hopelessness because of the difficulties in making the effects visible or recognized, has  replied, "Often. Pretty badly."

[114] One journal devoted to Chernobyl research,  *Ecological Anthropology*, is published on the basis of proceedings of an annual Chernobyl conference organized by the Belarusian Committee "Children of Chernobyl" (the collect was published under the title *Chernobyl Catastrophe* in the period 1992-1995). According to its editor, Tamara Belookaya, the fact that scientific publications from the neighboring Ukraine and Russia rarely make it to researchers in Belarus explains the popularity of their volume.

# Chapter 5.

## Scientists and the State: In/Visibility through Formal Representations

As has been argued in the previous chapters, the production of invisibility is a relative category; visibility increases or decreases as a result of interactions between particular social positions. This chapter considers interaction between expert perspectives in the context of changing state interests, and how these perspectives are reflected in formal representations of Chernobyl consequences. Because radiation is not directly perceptible, the politics of this formal representations (standards, thresholds, visual mapping) are of particular importance to defining the scope of the consequences. Indeed, it will be demonstrated that the politics of formal representations are probably the most important factor in the production of invisibility of the Chernobyl accident and its consequences.

The previous chapters have drawn attention to how Chernobyl-related knowledge production practices are constrained on international and national levels; the chapters have discussed socio-economic factors, the 'peripheral' position of Belarusian science, and influences of international nuclear organizations. This chapter turns to defining the scope of the consequences and setting the limits to 'Chernobyl' through formal criteria. As part of this analysis, I propose the concept of *mis/alignment* of formal representations with respect to empirical complexity to describe how the consequences of the accident are made more or less visible as a result of dissociation among formal representations, as well as between formal representations and empirical experience enabled under existing technoscientific and socio-economic conditions. The chapter stresses that mis/alignment is a relative process (it is a question of more or less visibility); perfect state of alignment is impossible.

Analysis in this chapter is based on several examples. First, I illustrate the early efforts to establish formal representations of the Chernobyl consequences and how the politics are transformed by use of formal representations. Second, relative aligning and misaligning efforts are demonstrated on the example of historically successive principles ('concepts') of radiation protection in Belarus, which effectively re-draw the scope of radiation danger in the country. Third, activities of the Independent Institute of Radiation Safety “Belrad” are used to describe the work involved in 'making visible' through formal representations (which includes but is not limited to aligning of formalisms). For all of these cases, making invisible through formal representations is analyzed in relationship to secrecy, accountability, and organization of expertise.

## The Politics of Formal Representations and Mis/alignment

This section provides the theoretical foundation for the discussion in the rest of the chapter, starting from the concept of ‘formal representations,’ which I discuss on the basis of earlier research in science and technology studies (Star 1995; Bowers 1992; Bowker and Star 1999). I suggest the concept of “mis/alignment” of formal representation and discuss its relationship to production of in/visibility.

## Formal Representations

According to the 2001 Belarusian National Report on Chernobyl, “The experience, gained during activities carried out in the initial post-accident period, dictated the necessity of a systematic solution” for mitigation of the Chernobyl accident (Belarus 2001: 36); the first [Soviet-] Republican Program of Mitigation of the Consequences was designed in July 1989. Planning for a coordinated, large-scale, and long-term effort needed a scientifically-based concept of radiation protection: a formal representation of the scope and character of radiation danger in the Republic with in-built standards of safety, criteria for identifying populations that are “at risk,” and interpretation of the ways in which the danger and its consequences can be minimalized. To understand how these representations are used to make consequences of an accident more or less visible, the question of the politics of formal representations has to be considered (Star 1995; Bowers 1992).

Star describes “formal (mathematical, computational, abstract) representations” (1995, 89). These representations are logical and “immutable” (Latour 1986) in the sense that they are less dependent on contingencies of local circumstances for their meaning. Quoting from Latour, Star writes: "'What we call formalism is the acceleration of displacement without transformation.' By this [Latour] means that information presented in formalisms is both the most portable and the most unchanging, precisely because it is both abstract and recoverable" (1995, 92). The empirical representations formalized representations derive from are more situated, contingent, and ad hoc.

Formal representations can be seen as “rules” or as forms of work; work has to be done to create these formalisms (and then to make them usable in practice). According to

Star, “The primary kinds of work involved in creating formal representations are: abstracting (removing specific properties), quantifying, making hierarchies, classifying and standardizing, and simplifying” (1995, 90). The politics of formal representations are in judgments about what properties of the phenomenon to include in its formalized descriptions and what to throw out in these processes of abstraction, simplification, and standardization (Star 1995; Bowers 1992). Star refers to “gaps” between formal representations and the empirical complexity they are describing as the central tension in creating and using formal representations; she argues that essentially the question is about how to keep visible what is "slipping away" or "what is left out when formalisms are created" (1995, 101), i.e., complexity of empirical experience and local contingencies. [115] According to Star, “These gaps become progressively more invisible, or ‘glossed over’ as the work becomes more formal” (1995, 98). Much of Star's analysis (1995) is about the work that has to be done to “instantiate” formal representations in practice.

Use of formal representations (e.g., reliance on information technologies) changes the politics in significant ways: formal representations “seem neutral or objective to many, if not most, people” (1995, 112); there is “an illusion of completeness of information”; and the decision-making process behind these formal representations is rendered invisible (1995, 112).

To summarize Star's discussion of formal representations as it applies to the analysis in this chapter, some aspects that constitute richness, complexity, and situatedness of the empirical experience of the phenomenon are excluded in the process

---

[115] Star (1995) notes that much of sociology of science is documenting gaps between phenomena and representations.

of creating formal representations. What properties are preserved or excluded is at the heart of the politics of formal representations; yet to many people these representations seem neutral, objective, and exhaustive (of empirical descriptions of the reality).

Bowker and Star (1999) describe the creating of formal representations-such as categories and standards-as part of work that supports and enables large information infrastructures. One of the particularly important insights from their work is that determining the "degree of granularity"—that is, of specificity and concreteness—of these categories means making decisions about what will be visible or invisible within the system; they speak about the "practical politics of classifying and standardizing" (1999, 44). Furthermore, the authors pose the interdependence between social worlds and their "information artifacts": standards reflect and carry with them the context that has shaped them.

In her discussion of "sick-building syndrome" and determining health effects of low-level chemical exposures, Michelle Murphy uses the concept of "domains of imperceptibility" to refer to areas ignored in knowledge production practices, which are necessarily selective in what they describe and how: "domains of imperceptibility" are "the inevitable results of tangible ways scientists and laypeople came to render chemical exposures measurable, quantifiable, assessable, and knowable in some ways but not others" (2006, 9). Murphy's argument is that through the design of tools and experiments what becomes knowable may be manipulated: "Over the course of the twentieth century imperceptibility itself became a quality that could be produced through the design of experiments or monitoring equipment in order to render claims of chemical exposures uncertain" (2006, 10). The concept of mis/alignment described below focuses on similar strategically selective attention to empirical complexity of the phenomenon and the question of what properties of the phenomenon are left out and become invisible.[116]

**Mis/alignment**

The analysis focuses on the production of invisibility of the hazard through mis/alignment of formal representations both among themselves and with respect to empirical measurements that can be done under existing socio-economic and technoscientific conditions. Mis/alignment is *not* an absolute state describing whether or not representations are "true" to "reality" or scientifically valid.[117] Formal representations are necessarily selective—they can not be exhaustive with respect to complexity and contingency of empirical representations, —but they can be more or less descriptive, and in this sense, mis/alignment is a *relative process*. Invisibility of the hazard can be dramatically increased or reduced through adjusting formal representations of it (these re-definitions of formal representations are typically more complex than simply adjusting thresholds for "acceptable" exposures up or down).

Mis/alignment is not just a relative process, it is also a dialogical or interactive process: it is based on interaction of different (expert) perspectives, where the work of alignment or misalignment (and, thus, increasing or reducing the visibility of the scope of the hazard and its consequences) is done relative to perspectives of other groups of

[116] Arguably, material regimes of imperceptibility (design of tools, techniques, and experiments) also rely, at least in part, on the politics of formal representations: what aspects of empirical experience are made knowable through in-built standards, thresholds, classifications, and other formal representations.
[117] The main example of formal representations addressed in this chapter—concepts of radiation protection—is a *precautionary* tool; scientific knowledge that these concepts are based on is necessarily partial and uncertain with respect to actuality and the full scope of the consequences.

experts. The process is historically specific; it describes particular historical perspectives, tools, standards; the role and usefulness of particular formal representations can change when broader circumstances change. Alignment can thus be interpreted as the constant work of creating more usable or less problematic representations. How easy they are to use, and the politics of what they focus on defines infrastructural knowledge practices: that is, what data is identified as relevant, collected, stored, and analyzed within these infrastructures.

Tying misalignment back to Star's description of formal representations, the concept refers to the work of defining formal representations in ways that exploit the always-present tension between formal representations and empirical complexity and increase the areas where particular empirical data is irrelevant and invisible. Alignment is the work (or the relative state) aiming at the opposite: making representations more consistent and increasing their sensitivity to empirical complexity—relative to particular ethical and expert perspectives and actual conditions. The trade-off for increased visibility, i.e., the higher sensitivity or granularity of formal representations, might be greater costs and volumes of information to be managed (Bowker and Star 1999). Adjusting formal indicators to existing practical conditions of measurements is essential to the processes of alignment. How descriptive or useful particular formal representations are depends, for example, on infrastructures and tools used (e.g., their costs, accuracy, and availability),[118] and on particular political and socio-economic circumstances.

[118] For example, availability of simple, inexpensive technoscientific "fixes" (e.g., a cheap and easy-to-use individual radiation detection kit and/or a “pill” that decreases levels of internal radiation) might affect

**Misalignment, Articulation Work, and Secrecy**

The types of work that alignment involves include *articulation work* (Strauss 1985, 1988; Strauss and Corbin 1993; Schmidt and Simone 1996; Strauss and Star 1999; Fujimura 1987). Assessing the extent to which formalisms underlying infrastructures of radiation protection continue to be aligned with empirical experiences depends on experts questioning and 'unblackboxing' these formal representations, and articulating inconsistences, oversight, and actual or potential implications. This work can only be done from particular technoscientific and bureaucratic positions: it requires having relevant scientific knowledge, the right equipment, credentials, access to public spaces and opportunities to affect the existing criteria and standards. The work requires expert training, but it is also always a "political and public issue" (Bowker and Star 1999, 50). It is thus an issue of accountability of experts and transparency of decision-making processes (Jasanoff 2003). Alignment of formal representations is hampered under the conditions of secrecy, which is illustrated by the example of the late Soviet period, and developing and adjusting concepts of radiation protection (see below).[119] Alignment also requires "situated knowledge" of the local conditions.

The next section provides a brief introduction to the context of early radiation protection efforts, including infrastructure-building. The analysis offered below is not meant as a historical account duplicating already existing literature (Gould 1990; Marples

---

what large-scale infrastructural efforts are deemed necessary and create the conditions for adjusting formal representations.

[119] Because articulation work is fundamentally important to alignment of formalisms, I suggest that the connection would hold for other contexts as well, including Western nuclear industry contexts.

1988, 1996a, 1996b, 1999; Medvedev 1992; Mould 1988, 2000; Read 1993); rather it emphasizes the politics of formal representations, which is interpreted in its connection to state secrecy and the production of invisibility of the Chernobyl consequences. The section also provides background for the subsequent discussion of mis/alignment in radiation protection.

## Formal Representations under Conditions of Secrecy

Formal representations of Chernobyl radioactive contamination and its consequences address not controlled, laboratory conditions, but complex 'real life' circumstances where multiple interconnected factors affect exposures and resultant health effects (see chapter 6). The identified extensive scope and temporality of the problem create the need for infrastructural efforts far exceeding what would commonly be understood by 'radiation protection.' Belarusian government reports having resettled 135, 000 residents; another 200,000 left the territories on their own, and the majority of them were young people and professionals (Belarus 2003). Resettlement called for building new educational and medical establishments. Radiation protection measures for people who stayed on the affected territories included building new local roads with firm cover and water-pipe networks, as well as gasification of the area—all for radiation protection. This is in addition to extensive measures of deactivation, development of methods of agricultural production on the affected territories (where possible), restoring disrupted economic and social activities, reviving collective farms, and solving the problem of continuing lack of qualified personnel on the affected territories. Thus, radiation protection in this case is much more than deactivating the environment and measuring radiation levels in food products or in human bodies.

The next two sections illustrate the process of creating formal representations and establishing radiation protection infrastructures. Early efforts of the Belarusian scientists described in the next section are summarized on the basis of the account of one key participant, Ivan Nikitchenko, vice-head of *Gosagroprom* (Ministry of Agriculture) of the Belarusian SSR in 1985-91, who lead efforts at radiological monitoring and organization of radiation control infrastructure in the agricultural sector.

## Establishing Radiation Protection Infrastructures in Belarus

Ivan Nikitchenko (1999) offers a rare firsthand account documenting early radiation protection efforts in Belarus. His account points to the conflicts within the system: following an extensive effort to establish radiation protection infrastructures, the information and data they produced were frequently ignored, and top-down directives, often coming from Moscow, guided the decisions.

Establishing infrastructures and creating first formal representations of the scope of contamination took several months. Though the first contamination maps of the Republic were created in June and July of 1986,[120] there were not enough dosimeters of adequate sensitivity to measure levels of radioactivity in food supplies, and not enough specialists. Equipment was slowly brought over from other parts of the Soviet Union.

[120] According to Nikitchenko (1999), measurements of the radioactive contamination of the environment were conducted based on the instructions of the Ministry of Agriculture and Ministry of Health (anecdotal accounts typically point to rather negligent and approximate measurement practices). The results of the measurements were rendered as colored areas on maps of districts and regions. Nikitchenko also notes that, in addition to radioactive substances, areas were contaminated with relatively high levels of *heavy metals*, including lead, mercury, and cadmium (the kind of contamination not mentioned often).

By October of 1986, 3,077 radiation control specialists were prepared; methods were devised for various types of measurements (e.g., express analysis of β-emitting radionuclides in water and foodstuffs).

The network of radiation control centers had to include a significant number of existing food processing plants in the Republic, partially due to the fact that, following the accident, contaminated food supplies had been processed throughout the Republic (Nikitchenko 1999). Together with scientific laboratories, hundreds of food processing plants, more than a thousand of affected collective farms, various public sanitation stations, and other enterprises, the system of radiation control included 2,122 centers (Nikitchenko 1999).[121]

Based on the work done in the second half of 1986 and the first half of 1987, Ministry of Health and Ministry of Agriculture developed the "System of Radiation Control for Food Supplies, Agricultural Products, and the Environment in the Belarusian SSR" (Nikitchenko 1999, 76). The System [Infrastructure] of Radiation Control relied on an extensive network of radiation control centers with established lines of communication and command, multiple instructions and directives, as well as required analyses, generalizations, and mapping. Within this system, however, collected information existed independently from the decision-making process: decisions were made by administrators based on directives from above, often coming from Moscow (see below),

[121] Nikitchenko specifically lists "all 27 meat processing plants, 127 dairy processing enterprises, 114 food production enterprises, 61 bakery and bread production enterprises, 56 fruit and vegetable processing enterprises, and 1,200 collective farms, which included contaminated areas" (Nikitchenko 1999, 74).

and not on the information available (Nikitchenko 1999). Adopted decisions and their consequences were made invisible by strict secrecy.[122]

**The Soviet Directive and Apparent 'Neutrality' of Formal Representations**

The Soviet administration of the Chernobyl aftermath is 'obviously' inhumane in some respects, as illustrated below. But then there are also Chernobyl policies expressed with numbers—such as setting thresholds and 'acceptable' levels of contamination—where the politics and implications are not immediately 'apparent'; interpreting these numbers requires reference points that are rather specialized and outside of common knowledge. These formal representations appear more neutral and objective (Star 1995). Even if decisions behind the numbers are no less atrocious—in the "banality of evil" kind of way (Arendt 1999[1963]; Star 1995)—interpreting them in this way requires extended explanations and even 'proofs.' The problem, then, is making the politics behind these numbers and technical decisions more visible (without trivializing the 'technical' detail).

Three separate examples of the 'obvious' politics in the Soviet handling of the aftermath should be sufficient (the examples are contrasted with more 'technical' cases below). First, groups of residents in Belarus continued living on heavily contaminated territories in Mogilev Region—with levels of contamination comparable to those around the reactor—without knowing anything for four to seven years. Second, in attempts to create an image of containment of the accident, people were resettled from the 30-kilometer area around the reactor to other contaminated areas; later these territories were

[122] In the first years after the accident, people were not informed that their foodstuffs were contaminated and not suitable for consumption, or about elementary measures of radiation protection they could follow (Nikitchenko 1999).

transformed to a regime of strong control, and all social and economic activities were haulted. Yet, in 1987-88, gas pipelines, schools, and health centers (*poliklinika*) were built on these territories (Matsko and Imanaka 1998, 32; Yaroshinskaya 1998).[123] Finally, the third example is the Soviet politics with respect to diagnosis: starting from instructions immediately after the accident to record acute radiation syndrome (ARS) as VvD (Petryna 2002; Yaroshinskaya 1998b; Lupandin 1998)[124] to later instructions not to record other diseases that could be linked to radiation (Nikitchenko 1999). Belarusian experts maintain that acute radiation syndrome was not diagnosed for laypeople and that incredibly high doses received by groups of lay population have not been registered or have been made secret.[125]

The following examples rely more heavily on thresholds and 'acceptable' levels, but their meaning can be interpreted with reference to the general historical context. Tentative acceptable levels for radioactive contamination of agricultural produce were set very high, and "practically all the yield of 1986 was processed to be consumed, except for the yield from the 30-km zone" (Nikitchenko 1999, 32). Meat with levels of radioactivity exceeding set levels was mixed with "clean" meat (Nikitchenko 1999). "Contaminated" grains were sent to chicken and pig farms where they were fed to animals, while it was commonly considered that chicken meat, eggs, and pork were not

---

123 These and similar facts are still not put together in a coherent way that would make visible the timeline and the scope of the concealment efforts.

124 The instructions on diagnosing acute radiation syndrome were published on May 2, 1986.

125 Yaroshinsakaya (1998a) provides evidence that doses and diagnoses were concealed. She uses a variety of sources to suggest that 2,600 children (3.4 % of the whole child population) in the Kiev, Zhitomir and Chernigov regions received iodine doses exceeding 500 rem. Yaroshinskaya questions the validity of dose estimates made by Soviet experts: "WHO and WHEN had ACTUALLY evaluated the doses received by the population in the first 2-3 months? I know very well about the efforts made by the officials in Narodichi District of Zhitormir Region in order to eliminate preliminary medical documents representing the ACTUAL doses. Instead, medical stafff were ordered to register understated dose values" (Yaroshinskaya 1998a, 114; see also Alexievich 1999).

radioactive (Nikitchenko 1999, 38). The only place where this produce could not be brought was to Moscow (Matsko and Imanaka 1998). Doses created in that way have not been accounted for (Nikitchenko 1999).[126]

The cases above describe neglect, blatant manipulation of data, and obvious lack of concern for people's well-being. The implications of the cases described below are no less troubling, but they are more difficult to interpret. Shielded with secrecy and facilitated by power hierarchies, inhumane politics might become barely 'discernable' behind inconspicuous technical standards.[127] Again, the politics of these numbers are not contained 'within' themselves; rather these formal representations acquire their meaning with reference to actual circumstances in practice; interpreting them thus requires contextual, along with relevant 'technical' knowledge.

In 1987, the Ministry of Health set the dose limit for life at 50 rem (500mSv)/70 years (Nikitchenko 1999, 48).[128] In the same year, it was concluded that people couldf remain on the territories with levels of contamination exceeding 40 Ci/km² (and up to 80 Ci/km²; compare to the later levels, table 5.1)—provided import of clean foodstuffs, especially milk, and further "complex measures" aimed at decontamination and facilitation of agricultural production (Nesterenko 2004). There was indeed an effort to provide the affected regions with clean food supplies in 1988-89; but it generally was not feasible in the economic conditions at the time. In the last years of the Soviet Union, the

---

[126] Most of the scientists continue to rely on calculations of the early doses made by Soviet expert (Researcher from the former Institute of Radiation Medicine, personal interview).

[127] On Soviet secrecy in the post-Chernobyl context, see Medvedev (1992), Petryna (2002), Marples (1996), Schmidt (2003).

[128] Soon after the accident, on May 3, 1986, the National Committee for Radiation Protection of the USSR set the maximum radiation dose limit at 500mSv/*year* for the population in general; and 100mSv/*year* for children under 14, pregnant women, and nursing mothers. On May 22, 1986, the limit of 100mSv/year was set for the whole population (Belarus 2001, 31).

shortage of food products was a general problem at the time; shelves in grocery stores were practically empty.

In 1988-1990, the full volume of agricultural production continued on the territories with radioactive contamination up to 80 Ci/km², with only slightly lowered acceptable thresholds for radioactive contamination of food supplies (lowered in 1987-88) (Nikitchenko 1999, 48). "Complex measures" to reduce radioactive contamination in agricultural produce proved to be similarly problematic: despite all the measures, obtaining clean food products on the affected territories could not be achieved. According to Nikitchenko (1999), the main mistake by the Belarusian Ministry of Agricultural Production was in believing that it was possible to grow clean produce on contaminated territories, as claimed by Soviet experts. Measures suggested for state agricultural production and restrictions on private farming among rural populations were inadequate and unrealistic.[129]

## Mis/alignment and the Concepts of Radiation Protection

This section describes mis/alignment on the example of post-Chernobyl radiation protection concepts: the Soviet "35 rem" concept (or so-called Safe Living concept), the 1989 concept developed by Belarusian scientists, and the 1995 Belarusian concept. The analysis in this section is concerned with the scope of the Chernobyl consequences these concepts make visible relative to each other, and with how closely they account for empirical complexity in existing technoscientific and socio-economic conditions. The "35 rem" concept was developed by Soviet nuclear experts in 1988, supported by IAEA

[129] For description and critique of the measures, see Nesterenko 1998 and Nikitchenko 1999.

and WHO, and rejected by the Belarusian scientists, who developed an alternative concept (also discussed in chapters 2 and 3). The 1995 "new concept" corresponds to the changes in Chernobyl-related policies of the Belarusian government in the mid-1990s (see chapter 2), and, unlike the first two, was barely discussed in the media. To demonstrate the process of mis/alignment of formal representations and the production of in/visibility of the Chernobyl consequences, the concepts are described in their dialogical context, relative to each other, and to socio-political circumstances at the time.

### The Safe Living Concept

As discussed in the previous section, 1987 Soviet radiation protection measures that would remove the need for relocating the populations—providing populations on the affected territories with "clean" food supplies and "complex measures" to enable production of clean food supplies on the contaminated territories—were proving either impossible or ineffective. The "35 rem" concept, which set a new limit of maximum dose per life, was proposed by the National Committee on Radiation Protection headed by Academician L.A. Ilyin, and approved in the late fall of 1988 (Malko 1998; Matsko and Imanaka 1998). The concept was based on the prognosis by Soviet radiation protection experts in the summer of 1986; the prognosis was revised in late 1988.[130] The

[130] The first open presentation of the prognosis was not made until March 1989, when the report titled "Radio-contamination Patterns and Possible Health Consequences of the Accident at the Chernobyl Nuclear Power Plant" was presented by Academician L.A. Ilyin at the General Session of the Academy of Medical Science of the USSR in Moscow (Yaroshevksaya 1998a). Predictions were made for "three levels of exposure of the whole population and separately for children aged 0-7 at the time of the accident: 1) for 39 districts of 9 regions where the levels of exposure were relatively high (total population about 1.5 million, including 158,000 children); 2) for the entire population of these regions (15.6 million, including 1.666 million children aged 0-7 years); and 3) for the population of the central regions of the European part of the USSR (75 million, including 8 million children aged 0-7)" (Yaroshevksaya 1998a, 114). According to Yaroshinksyaa, the report claims that, "the estimation of late effects was based on the actual doses in the

Soviet scientists argued that health effects caused by radiation exposures after the Chernobyl accident will be "in the range of values less than standard deviation of spontaneous levels of the corresponding pathology" (quoted in Malko 1998, 7). According to Malko, the concept made the following assumptions:

> - [T]he sum of external and internal doses that can be delivered to a person as a result of the Chernobyl accident will not exceed 350mSV within a 70 year period beginning [...] the 26th of April 1986, in the majority of the contaminated areas of the USSR;
> - an additional dose of radiation equal [to] or less than 350 mSv accumulated within the whole lifetime on the contaminated territory will have no significant medical consequences for the people (Malko 1998, 7).

Malko describes that, in accordance with these assumptions, additional radiation protection measures, including relocation, were no longer necessary in practically all affected areas of Belarus, Russian and Ukraine. Implementation of the program—lifting all restrictions introduced on the contaminated areas after the accident—was projected to begin in January 1990 (Malko 1998, 7). In other words, the 35 rem concept claimed that people can live safely anywhere except for the zone of alienation (where the evacuations happened in 1986), and that agricultural production on the contaminated territories did not pose a problem (additional decontamination measures might be required, if projected doses in particular locations were to exceed 350mSv) (Nikitchenko 1999, 145; Malko 1998).

---

four years following the accident and on the projected doses until 2060, the latter having been calculated on the assumption that restrictions on the use of home-grown products would be lifted in the strict control zones."

**The Moment of "Emerging Plurality" and Two Conflicting Perspectives**

What followed is described in chapter 2 as a moment of "emerging plurality" in post-Chernobyl history; it was a period of increasing media and civil society participation. During this period, growing dissent of the Belarusian intelligencia,[131] including local scientists, was challenging the Soviet handling of the Chernobyl aftermath and the Soviet scientists' assessment of Chernobyl consequences, which were interpreted as attempts to downplay and conceal the real consequences. Petryna (2002) describes similar perspectives for Ukraine in the last years of the Soviet Union.[132] Alla Yaroshinskaya (1998b), a former People's Deputy of the USSR from one of the affected regions in Russia, [133] considers the difference between expert perspectives not in terms of scientific theories, but in terms of political agendas: the Soviet scientists represented the interests of the Soviet apparatus, and "[a] closed society and glastnost' [openness] of the Chernobyl effects were ideologically incompatible with each other" (Yaroshinskaya 1998b, 25). According to Yaroshinskaya, the difference persisted after the collapse of the Soviet Union: "medical officials in the soviet and post-soviet society [...] have been concealing the truth from the soviet and the world public for years," whereas independent scientists (scientists from the former Soviet Republics who were not part of the Soviet apparatus) have been "anxious about the facts of concealment of the truth on

---

[131] For the discussion of the Belarusian national intelligencia, nationalist movement in Belarus, and the Chernobyl question, see Marples (1996), Zaprudnik (1993).

[132] Opposition to the Soviet perspective in Ukraine was particularly pronounced there; it came together with nationalist and state-building agenda. In this case, too, development of the Ukrainian concept of radiation protection could not be interpreted as scientific disagreement. The Soviet apparatus and its scientists failed to protect the people and tried to conceal the truth. In 1991, when Ukraine declared its independence from the USSR, its leaders denounced the Soviet handling of the Chernobyl accident as "an act of genocide" (Petryna 2002, 22).

[133] Alla Yaroshinskaya served as a People's Deputy of the USSR from Zhitomir Region in Russia in 1989. She later organized Yaroshinskaya Charity Fund, Moscow.

actual radiation doses, received by inhabitants of the areas around the Chernobyl NPP, as well as about impacts of low radiation doses on human health" (Yaroshinskaya 1998b, 14). The full range of the post-Soviet expert opinions is rather complex, but what matters is the discernible difference in the direction of effort, where some experts are trying to reveal the existence of the phenomenon concealed by systematic methodological choices of other experts; this difference persists to this day and extends beyond the former Soviet Union.[134] As demonstrated in chapter 3, the international nuclear industry representatives continue referring approvingly to the estimates made by the Soviet scientists. On the other hand, local critics who have disagreed with the Soviet conception in the late 1980s-early 1990s, and continue attempts to 'reveal' the scope of Chernobyl consequences, refer to position statements and research on low-level radiation exposures by Western critics of the nuclear industry, such as John Gofman and Rosalie Bertell (e.g. Yarhoshinskaya 1998b; Nesterenko 1998; Malko 1998.)

In the context of early conceptions of radiation protection in the last years of the Soviet Union, both groups of experts had rather particular characteristics. The Soviet nuclear scientists had long been working under the conditions of strict secrecy; many had worked previously in the Soviet nuclear production sites in the Southern Urals, where the disasters of the 1950s were also covered and denied by the Soviet government (Medvedev 1979; Josephson 2005). The greater scope of the Chernobyl accident-far exceeding what was admitted publicly by the Soviet authorities--was made visible several years after the accident by oppositional experts and civil organizations; no less important

[134] Ulrich Beck (1992) writes about efforts to reveal and conceal as the basic tension with respect to production of knowledge about all invisible modern technological risks.

was their documentation of the nearly criminal negligence in radiation protection and in collecting health and dosimetric information.[135] Until 1989, all documents pertaining to the accident were classified, and the number of experts who had access to relevant data was limited. Historically, then, a particular role was played by persons who were “within the system”—as scientists with nuclear clearance or as People's Deputies to the Supreme Soviet with access to more information that an average citizen. The extent to which we know about the Chernobyl consequences reflects efforts undertaken by these experts and politicians in the context of great political transformation in the last years of the Soviet Union. My analysis here too relies on the ‘uncovering’ of the Soviet secrecy by the Belarusian intellectuals, including those who led radiation protection efforts during Soviet times (Nikitchenko 1999; Nesterenko 1998, 2004) and public representatives such as Yaroshinskaya (1998a, 1998b), as well as later systematizing efforts by scientists and social scientists describing the first Soviet efforts (Matsko and Imanaka 1998; Petryna 2002).

**The 1989 Belarusian Concept**

The Belarusian scientists' critique of the Safe Living concept was concerned precisely with areas where the concept obscured empirical complexity of the post-Chernobyl circumstances. Criticism of the concept included: its lack of effective

[135] The key public figures that pressured the government to declassify Chernobyl documents in 1989 were the oppositional leaders and public intellectuals, including importantly the writer Alex Adamovich and others. Particularly important for understanding the shaping of formalisms – principles of radiation protection – in Belarus is the book by Ivan Nikitchenko *Chernobyl: How It Happened* (1999). Nikitchenko himself is one of the authors of the Belarusian concept of radiation protection and one of the few scientists involved in estimating the scope of the accident and design of radiation protection principles from the very beginning. In his 1999 book, Nikitchenko has made public some of the key official documents describing the history of radiation protection infrastructures in Belarus.

mechanisms for keeping track of dose burdens; the fact that assessments of stochastic effects were not made related to the specifics of the situation at hand; that the concept did not include analysis of the irradiation of different groups in the first period after the accident (when people lived without any restrictions and without adequate iodine prophylactics); that it ignored an additional factor of iodine endemicity in some territories; and that it did not factor in separate accumulations of plutonium, strontium, or "hot" particles.  Formulation of the concept in terms of individual dose burdens (and not, for example, the density of contamination of particular territories) led Nesterenko to argue that, "the Ministry of Health of the USSR effectively left the population without measures of radiation protection, inviting them to take care of their health in unrealistic ways" (1998, 38).

An alternative Belarusian concept was suggested and approved in 1989 and later became the foundation for the Chernobyl laws (see below).  In  September 1989, however, ninety-two scientists, including five Belarusian scientists, signed a letter to Mikhail Gorbachev that expressed the scientists' support for the "35 rem" concept--on the grounds that it was supported by the international experts and based on the data from Hiroshima and Nagasaki studies (see Nikitchenko 1999).[136]  Nikitchenko describes the letter by the Belarusian scientists supporting the Moscow concept as "smooth on paper" (1998, 60).

---

[136] Remarkably, this letter—written in defense of the concept that offered practically no ways to keep track of individual exposures and assumed that these exposures were safe for people's health—also borrowed the strategy from their opponents and was attempting to discredit the other perspective by *revealing the aspects of empirical complexity that the other concept would be insensitive to:* it pointed that using 'zones' with various levels of contamination to differentiate between different levels of exposures ignored considerable variability among the population living in the same 'zone.' The letter also insisted on the significant experience and unquestionable expertise of international and Soviet experts.  Research, background, and views of one of the scientists who signed the letter, A.M. Skryabin, is described in chapter 6.

One of the key scientists behind the Belarusian concept, when asked in 2004 whether he still believed in the main principles of the Belarusian concepts, replied that his views had not changed, the concept was still alive: "There is not anything better than that concept yet anyway." The 1989 Belarusian concept was based on two assumptions: first, that there is no threshold for radiation effects, and low-level doses were also dangerous; and, second, that radiation effects were not always pathology:[137] the radiation factor could also increase sensitivity to influences of other, non-radiological, factors. The concept set the acceptable irradiation limit at no higher than 1 mSv per year (See Matsko and Imanaka 1998; Belarus 1996, 2001, 2003). The whole territory was divided into 'zones' based on the density of radionuclide pollution (calculated based on cesium, strontium, and plutonium levels) in combination with limits for the average annual effective doses for different zones (see table 5.1). Different radiation protection measures—from periodic radiation control to mandatory resettlement—corresponded to different zones.

[137] That is, dose accumulation after a certain level can lead to development of pathology.

**Table 5.1** Zoning of Belarus according to Levels of Radioactive Contamination and Dose Loads on the Population

| Zone Description | Equivalent Dose, mSv/year | Contamination Density, $kBq/m^2$ ($Ci/km^2$) | | |
|---|---|---|---|---|
| | | Cs-137 | Sr-90 | Pu-238, -239, -240 |
| Residence zone with periodic radiation control | < 1 | 37-185 (1-5) | 5.55-18.5 | 0.37-0.74 |
| Zone with the right to resettling | > 1, but < 5 | 185-555 (5-15) | 18.5-74 | 0.74-1.85 |
| Zone of subsequent resettling | > 5 | 555-1480 (15-40) | 74-111 | 1.85-3.7 |
| Zone of primary resettling | > 5 | > 1480 (>40) | >111 | >3.7 |
| Evacuation (exclusion) zone | Territory around the Chernobyl NPP; the population evacuated in 1986 | | | |

Source: Belarus 2001, 37.

What matters here is how formal representations of the Chernobyl consequences are re-aligned with respect to empirical complexity, including the introduction of a greater number of indicators and methodological choices that ensure the possibility of practical application, i.e., choices that account for what can be measured under the actual practical conditions (on the 1989 Belarusian concept, see Nesterenko 1998, 38-39; Malko 1998).

Dividing the territory into 'zones' based on their level of contamination ('zoning'), which the Belarusian concept used as the main approach to controlling individual exposures, is not a perfect representation for the complex empirical conditions. There are still numerous empirical contingencies left unaccounted for that influenced individual dose burdens. This unaccounted complexity of data includes variability in terms of: individual doses, risk factors, and sensitivity and outcomes, as well as actual radionuclides distribution and behavior in the environment.[138] Zverev (1998) notes that the Chernobyl legislature in all three affected countries has been criticized as inadequate with respect to problems of estimating population doses. The criticism concerns methods of estimating doses, as well as how to account for "pecularities of release and migration of radionuclides, irradiation duration, [and] dose rate" (Zverev 1998, 269).[139]

The 1989 Belarusian concept has provided some degree of sensitivity by adopting several diverse criteria and by providing a relatively easy, though imperfect, way to visualize the scope of contamination by constructing maps of zones of the contamination (see 2001 map of radioactive contamination of Belarus, chapter 1, figure 1.1). At the same time, Vasilii Nesterenko and local radiologists often dismiss zoning maps, noting that they are not important, and that the coefficient of transfer (which depends on the type of soil) is what matters. These maps are also inaccurate in describing contamination in particular localities, but they are still used as a main reference.

As noted above, the Belarusian concept became the basis for the two Chernobyl laws: "On legal regulations of the territories exposed to radioactive contamination as a result of the catastrophe at the Chernobyl nuclear power plant," and "On social protection of citizens affected by the catastrophe at the Chernobyl nuclear power plant" (adopted by

---

[138] Radionuclides migrate in the environment; in some environments they are 'immobilized,' while in others they are highly mobile. Radionuclides also decay, transforming into less or significantly more dangerous elements. For example, plutonium decays into americium, which is not only more radioactive, but is also more toxic.

[139] More specifically, 'zoning' does not account for the following problems: radiation risks vary greatly in the population; estimating average individual dose is unreliable due to the great range of values; available dosimetric and epidemological data are not enough to model dose distribution and mortality in various regions, as well as people's unequal sensitivity to radiation; individual sensitivity to radiation appears to be an important factor determining outcomes of irradiation (Yu. O. Zitzer, leading specialist of the State Committee on Environmental Problems, Russian Federation, quoted in Zverev 1996, 269).

the Supreme Soviet of the Republic of Belarus in 1991).[140] The laws, in turn, changed the public visibility of the Chernobyl problems: the law "On social protection..." translated the zones (described by the Law "On legal regulations...") into levels of compensations and entitlements and laid the grounds for complex socio-economic and bureaucratic processes associated with resettlements and claiming benefits.[141] How many people were resettled in what years after 1991 is never explicitly discussed in the media or Chernobyl publications; it is often mentioned, however, that resettlements and compensations were a massive burden on the state, and that the state program of mitigating the consequences was never completely fulfilled. It did not take long for this approach to prove too expensive (see chapter 2).

### The 1995 Belarusian Concept

Revision of the concept in the mid-1990s resulted in an increase in 'granularity' and, consequently, reducing the visibility of the Chernobyl consequences.[142] The revised concept was not widely publicized. It was apparent from the press coverage that the approaches were changing in the mid-90s, but the exact nature of the change was not made clear to the public (see chapter 2).

The new concept was based on the work of a commission headed by Evgenii Petrovich Petryaev in the summer of 1993 (Marples 1996, 49). Marples wrote, based on

---

[140] With the laws, division into zones (zoning) becomes the basic approach to radiation protection (for the discussion of the Chernobyl laws and their implementation, see Marples 1996).

[141] Adriana Petryna (2002) describes this translation of potential risks into the logic of bureaucratic state compensations and citizen claims for the Ukrainian context.

[142] The shift in key criteria also made the concept less 'preventative,' and better accorded with the international approaches to radiation protection (with the difference that international approaches are largely theoretical, whereas in Belarus it is a matter of addressing actual circumstances) (Nesterenko 1998).

publications in the national press in 1993, that it was to adhere to the original concept of limit of 1mSv. The Committee aimed to focus more precisely on radiation effects on humans, and to rely on "dose load received by the population rather than the radiation levels in the soil." Marples continues that, "[i]n reality, it seems that the goal of the commission was to reduce significantly the area of dangerous contamination by somewhat artificial means, since costs of dealing with the tragedy's effects were well beyond the means of the Republic of Belarus." Marples includes the critique of the new concept offered in 1993 by Valeriy Shumilau:

> [T]he data on radiation exposure were far from precise, and ... the new concept tended to ignore the actual living conditions of the population. ... Two of the original yardsticks for protecting the population – contamination of the area and the effectiveness of protection measures—had been eliminated by the new concept (Marples 1996, 49).

According to Marples, "even with a revised concept, the government had sufficient funds to deal with only 58.4 percent of the total costs arising" (1996, 49).

The new concept described protective measures during the rehabilitation period, stating that the period of emergency measures was over and one had to "learn to live with radiation." Its key proposition was creating zones according to the following limits of individual annual doses: no protective measures were necessary where individual doses did not exceed 1mSv; most protective measures were focused on the territories with individual exposure levels of 1-5mSv; and settling on the territories exceeding 5mSv was not recommended. In an article from the Belarusian press quoted by Marples, Shumilau argued that the concept would exclude most of the territories 1-5 Ci/km$^2$ from social and radiation protection (see table 5.1). Indeed, from the second half of 1995 on, the government started terminating measures of radiation and social protection on the territories 1-5 Ci/km².[143]

Regardless of whether or not this was a justified decision, the new concept reduces the scope of contamination by way of redefining the criteria; this is not a matter of the actual process whereby the territories become cleaner (registered on the basis of the same criteria). Here, as with the other concepts discussed above, the recognized (visible) scope of the contamination depends on what criteria are selected, on how these criteria match actual socio-economic and technoscientific possibilities, and on increasing or decreasing the thresholds. The argument about reducing or expanding the areas of what is visible by adjusting the criteria has been made by Geoffrey Bowker and Susan Leigh Star (1999) in their analysis of classifications and information infrastructures. Ulrick Beck (1992) has made a similar observation for the general nature of controversies associated with modern (invisible) technological risks, where adjusting the threshold up or down defines reveals or conceals (more of) the hazard.[144]

The 1998 law on radiation protection, which specified the role of the state in radiation protection, was based on the new concept: it described annual and life doses, with the provision that the limits could be increased in case of an accident. A later addition to this law noted that protective measures were not cancelled with annual doses

[143] The concept was recommended by the National Committee of Radiation Protection in 1995 and became the basis for the new 1996-2000 Chernobyl program.

[144] The Independent Institute of Radiation Safety "Belrad" made public the data on the increase in the incidence of the contaminated food exceeding acceptable levels after 1996 (Nikitchenko 1999). The head of Belrad, Vasili Nesterenko, acknowledges the government's lack of capabilities to deal with the burden of the Chernobyl problem, but still suggests using more and different criteria, such as calculating not only the annual dose, but full dose since the accident. He suggests biological dosimetry to reconstruct total doses of radiation exposure, creation of a catalogue of total doses, and focusing primary assistance to those most affected and those with highest doses.

0.1mSv-1mSv.[145] An additional Chernobyl law was adopted in 2001; it again was not widely publicized, and it did not change the main principles of the new concept.

***

The section has described radiation protection concepts as formal representations and as work of experts. I have emphasized the *relative* work of production of in/visibility: different groups of experts make the hazard more or less visible—relative to perspectives of other experts and in particular historical circumstances—by adjusting formal representations. These efforts are not limited to adjusting thresholds of acceptable levels up or down. Recognized scope of contamination might be modified to reflect more or less empirical complexity and specificity of actual circumstances, including technological and socio-economic circumstances.

Earlier sections in this chapter have discussed the relationship between misalignment and broader political or organizational circumstances, including secrecy. The key insight in the next section is about the relationship between different types of making visible. Alignment of formal representations is often the kind of work that can only be done from particular technoscientific and bureaucratic positions, but this and other 'expert' types of work might be associated with other areas of the production of invisibility, including, for example, publicizing information about the hazard and maintaining transparency of the organization. The next section discusses 'expert' or technoscientific work of making visible and its relationship to particular structural

---

[145] This provision plays the key role in Belrad's activities discussed below.

conditions and positions. The analysis is based on the example of the Independent Institute for Radiation Safety “Belrad.”

## Alignment and Making Visible in Radiation Protection

In contrast to much earlier discussion, this section focuses on the kinds of work needed for the production of invisibility, including through formal representations. As mentioned above, this work includes articulation work and what in science and technology studies is referred to as 'unblackboxing.' In this case, ‘unblackboxing’ describes uncovering and critically evaluating the logic and politics of formal representations. In addition to ‘unblackboxing’ formal representations, production of visibility has to include articulating technical constraints, empirical conditions, socio-economic circumstances, and the needs of the affected populations, as well as storing and analyzing this data. Most of these types of work are continuous work, and this section offers a more nuanced description of interconnections between them.

The discussion below includes analysis of the unique position of the Independent Institute of Radiation Safety “Belrad” and its experts—with respect to the state government, international organizations, international charity foundations, international experts, and lay residents of the contaminated areas. This analysis confirms the importance of oppositional experts for establishing the visibility of environmental health effects (see Brown et al 2000; Strydom 2002), but it also illustrates that the value of an oppositional perspective is not absolute; what matters is particular structural conditions and relative dialogical perspectives.

Efforts of the Institute make the Chernobyl consequences visible in a number of ways: producing and maintaining technical equipment; supporting and employing experts; creating conditions for large numbers of measurements for people living on the contaminated territories;  analyzing the measurements and making the results publicly known; making their data publicly known and maintaining transparency of the work within the Institute.  All of these efforts can be provisionally be divided into three areas: radiation protection efforts (see table 5.2), public information and knowledge efforts, and transparency and accessibility of the Institute itself.[146]  Belrad's efforts to publicize the results of its efforts and describe the Chernobyl consequences in Belarus are so extensive that there is hardly any independent Western and Belarusian source on the post-Chernobyl situation in Belarus who does not rely on Nesterenko's data or even interviews with Nesterenko himself.  Other significant efforts at making Chernobyl consequences publicly visible include several significant publications authored by Nesterenko (e.g. 1998, 2004).  The Institute also provides support for scientists working on Chernobyl issues and falling out of favor with the government, such as Bandarzhevskaya, wife of Urji Bandarzhevsky who was put in prison (see chapter 4), or Gennadi Lazjuk, who was conducting extremely important research on hereditary conditions and lost the opportunity to continue his research.[147]

---

[146] Anybody can get tested for free on the stationary whole body counter (WBC) at the Institute; mobile WBCs are taken to the affected territories. The personnel of the Institute were very forth-coming with the interviews and sharing their data. Prof. Nesterenko offered for me to go on a trip with the radiological team from the Institute's Laboratory for the Spectrometry of Human Radiation.

[147] G. Lasjuk conducted important research on hereditary conditions and at the time I was conducting interviews in Minsk, Nesterenko was asking me about the kinds of funding that might be available for him to continue his research.

Without over-romanticizing the work done by the Institute, it is nevertheless significant that Belrad's efforts be recognized. Hero-making is almost inevitable in the description of Belrad's activities and the work of Vasilii Nesterenko himself; because, unlike any other non-governmental organization or state body, the Institute produces great amounts of public information about its projects.[148] Radiation protection in Belarus relies on state infrastructures, but these infrastructures themselves become increasingly "invisible" with time (see Bowker and Star 1999 on invisibility of infrastructures).[149] As should become clear from my description of Belrad's position (below), their efforts are not juxtaposed to the state efforts and in many way depend on being complementary to the state efforts and cooperation with the state government.

[148] While Belrad has to obtain funding for its projects, funding of the state infrastructures is not dependent on their performance or public knowledge about them.
[149] Without some privileged access, it is difficult to assess how well the state infrastructures are operating and what is the exact current scope of these infrastructures.

**Table 5.2** Radiation Protection Activities Carried out by the Independent Institute of Radiation Safety "Belrad"

- organized **local centers for radiation protection** and **courses** to prepare radiologists for these centers. The centers were first organized jointly with Comchernobyl. The centers tested products produced by the residents in their own farms/plots; the data was collected by BeRAD and analyzed.
- organized production of **dosimetric equipment** for measuring radiation in the environment and in food products.
- published and distributed **information booklets** on radiation protection for the population (booklets for the lay people described typical chains of radioactive contamination and basic measures of radiation protection)
- published results of the analysis of the food samples from LCRP, including online **bulletins**
- starting from 1996, maintains **whole body counters (WBCs)**, including mobile WBCs. Conducts measurements—mostly for children—in the affected regions. Results of the measurements are provided to the local communities. Particularly important programs include testing the efficiency of children's health recuperation trips, and the "Forgotten Villages" project (see below)
- established the **catalogue of doses**, based on WBC testing
- organized production and free distribution of **pectins**, apple extracts absorbing radionuclides
- in the process of organizing testing for the levels of **lead** and other heavy metals.[150]

### Belrad's Perspective

The current position of Belrad and the impact of its activities are no doubt affected by the unique role of its director with respect to the government, local opposition, international nuclear experts, and international charity foundations. Vasilii Nesterenko, former chief engineer and director of the Institute of Nuclear Energy, [151] is one of the top experts in the country, and has been an insider to power in terms of knowledge, credibility, and access to government administration. Nesterenko was one of the Belarusian experts involved immediately after the accident; the Institute of Nuclear Energy produced the first maps of contamination in the summer of 1986.[152]

---

[150] The Chernobyl accident also resulted in pollution with lead and other heavy metals, and Belrad experts are concerned with the combined radio-chemical influence of cesium and heavy metals. The equipment to test blood for lead accumulations, shipped from abroad, was still held at customs in 2004.

[151] A. Devoino, vice-president of Belrad, worked with Nesterenko at the INE.

[152] Immediately after the accident, he was flying over the site with Legasov. Nesterenko lost his position at the Institute of Nuclear Energy because of his notes to the Belarusian government on the scope of the danger and suggested actions.

The Institute is a non-governmental organization; much of its activities are funded by international charities and humanitarian funds.[153] However, unlike the oppositional perspectives in the newspaper *Narodnaya Volya* discussed in chapter 2, Nesterenko does not blame the government for insufficient attention to the Chernobyl problems. Belrad's efforts are not organized as a rebuttal to the general state policies; criticisms appear to be kept very specific, and generally Belrad personnel do not (over-)politicize the situation. Nesterenko makes it clear that an accident of this scope is too heavy of a burden for the Belarusian state and is, in fact, beyond the state's capabilities to deal with it: "The laws were adopted based on the assumption that we would have assistance." Nuclear plants are a "technology of rich countries," which might be able to afford the massive expense of the clean-up and relocations (although Nesterenko opposes any nuclear power plants, arguing that their "risk coefficient is too high").

Belrad's work is sanctioned by the state: the Institute had to pass accreditation, its radiation protection practices have to fit with the existing law, and some aspects of its activities have to be separately accredited by the state, including, for example, its dosimeters and the food additives, pectins, produced by the Institute (Phillips 2002). In some ways, the work of the Institute complements efforts by the state: while the state has established radiation protection infrastructures for its state agricultural production, Belrad's radiation protection efforts are focused on the private sector (where most of the contaminated foodstuffs are currently produced).[154] Describing the Institute's radiation

[153] The idea to create the institute was suggested to him by some of the such prominent public intellectuals and oppositional leaders as Ales' Adamovich and Andrei Sakharov; in his current role, Nesterenko, can be described as "oppositional expert" (Kroll-Smith et al. 2000).
[154] Nesterenko gives the following figures: the public sector food production contribute to less than one percent of individual doses, the private sector to 15%.

protection work, Nesterenko says that the principle of radiation protection is to protect the weakest, those the state infrastructures are not designed to protect (the most vulnerable persons or families or settlements).[155]

Nesterenko and other Belrad personnel are aware of the position of international organizations. Nesterenko's own work criticizes international assessment of the consequences, including the IAEA research projects, support for the 35 rem concept, and the German program of measurements that resulted in the misguided understanding of the dose accumulations in the zone 1-5 Ci/km².

Belrad's unique position is reflected in its particular vision of the temporality and spatiality of the Chernobyl problem:  the Institute's projects are concerned with the present radiological situation and especially the internal exposure (radionuclides consumed with food products and accumulated in vital organs), which can be juxtaposed with the emphasis on "normalization" or with focusing on thyroid cancers as the only significant consequence of the accident (the levels of iodine that damaged thyroid glands decreased soon after the accident, which makes emphasis on thyroid cancer an emphasis on the *past* effects). One staff member of the Institute observed in his interview, "We see a lot of consequences.  Not everybody agrees with us."  Focus on the present circumstances is not done at the expense of "leveling out" the historical distribution of doses; personnel at the Institute note that on average seventy percent of individual doses have already been received.  Nesterenko and other Belrad personnel insist on the danger of small doses (pathology is related to doses through risk coefficient) and observe that the

[155] Nesterenko comments that he was in the process of writing a reply to the head of the Gomel Center who apparently said that Nesterenko panics in vain, only five per cent of children [of some specific group] have accumulations exceeding the maximum acceptable limits.

most socially vulnerable groups are typically the ones with maximum individual doses (see chapter 6). Activities of the Institute emphasize protection of children as the most vulnerable category.[156]

There are Belarusian scientists who do not agree with the Belrad position, even among those who generally disagree with the IAEA position and the current state concept: they, for example, place an emphasis on the fact that people have already received most of their doses, or do not agree with the use of pectins. Critique of Nesterenko's work on behalf of other local experts concerns specifically the fact that he "works for his Western image."[157]

## Invisible Work of Making Visible

The network of local centers of radiation protection and using mobile whole body counters helps make visible contamination of food production in the private sector and internal accumulations of radionuclides. Organizing and conducting these measurements is work, and much of it is of the kind that Susan Leigh Star calls 'invisible work' (Star 1991; Star and Strauss 1999). Some of it is difficult technical work required to pass state accreditation of dosimeter equipment; it is also the work of maintenance, often technical and requiring expertise, as well as the administrative work of organizing, managing, and coordinating.

One example of this work of managing is Belrad's administration of the network of Local Centers of Radiation Protection (LCRP), where local radiologists collect about

[156] Nesterenko observes that there are 911 schools in Chernobyl areas, 19 orphanages, and 810 kindergartens.
[157] A scientist and a member of a Chernobyl NGO, personal interview.

thirty samples of foodstuffs from their village per month and send them to Belrad for analysis. The centers were originally established jointly with Comchernobyl, but then Comchernobyl ceased funding the Centers. Later, most of the centers managed and funded by Belrad (with the help of international charity projects) were transferred to state structures (most of them closed after that, due to lack of available funding) (Nesterenko 2004). One local radiologist observes that the system worked better when her center was under Nesterenko; everything was better organized, radiologists were paid slightly more.

Similarly, a physician from the former Center for Radiation Medicine in Minsk told me, that "the only functioning WBCs [whole body counters] are at Nesterenko's." Belrad acquired whole body counters in 1996 (with the help of funding from international charities, MacArthur Foundation, and the German government; the state structures financed only one round of WBC testing). Personnel of Belrad Laboratory for the Spectrometry of Human Radiation tell a long story of both the technological challenges of maintaining WBCs, and the massive bureaucracy they had to deal with to pass the process of accreditation. The Institute now keeps extensive records of all the measurements they take in a particular form (according to the head of the laboratory, this extensive documentation also made their work easier in some respects). At the same time, maintaining and calibrating expensive and technologically complex whole body counters (WBC) appears to be a problem for the state infrastructures; many local hospitals in the affected regions often do not have WBCs in a functioning state (Belookaya 2004a).

**Aligning Formalisms**

Another aspect of Belrad's work that merits special attention here is what I have referred to earlier as alignment of formalisms, e.g., the work of making practical contexts and implications of standards or inconsistencies between various criteria visible. This work of aligning formalisms is only possible in the dialogue with the state regulatory bodies and in the context of state radiation protection and regulatory practices. Belrad's work of alignment includes relying on actual measurements, triangulating them with various standards, and assessing the internal consistency of the Belarusian radiation protection standards.

Belrad emphasizes actual measurements instead of theoretical calculation of dose burdens of nameless "average citizens"—on the basis of both testing food products and measuring internal dose accumulations.[158] Results of actual measurements are then critically juxtaposed with existing norms and thresholds; Belrad publications, for example, include commentary based on triangulating or aligning different levels with the actual measurements, which I interpret here as uncovering the politics of formalisms. A particularly telling example is Belrad's project *Forgotten Villages*. Radiologists from Belrad went to test internal accumulations in "people from small villages that have long been forgotten," following reclassification of these villages as "clean."[159]

---

[158] Belrad's calculations are still theoretically grounded, of course (e.g., probability of diseases is linked to dose through risk coefficient), but calculations are also verified through practical measurements.

[159] According to Belrad radiologists, their measurements were doubted and retested extensively by the state scientists. One point of critique was the fact that Belrad routinely conducts most of its measurements of internal radionuclide accumulations in children. One of the reasons is that children are more susceptive to radiation exposure. The other, more trivial, reason is that it is difficult to find and test adults in the daytime in the village: adults are 'geographically distributed' all over the farm, etc. As a result, adults are generally underrepresented in Belrad's data.

Based on the results of the LCRP testing, Belrad has criticized the position of international organizations that there is no danger in the zone with a level of contamination of 1-5 Ci/km². It publishes tables of deviations from acceptable levels of radioactive contamination of food supplies, including in an online bulletin. Similarly, Belrad publishes lists of individual dose accumulations, including children who have dose burdens exceeding 0.3 mSv/year, the lower threshold that Belrad insists on for children.

As noted above, the goal is not to identify only average measurements, but also the highest levels. Although present-day levels are not comparable to extraordinary levels found in the early 1990s, there are still numerous cases of measurements above acceptable levels: now the maximum measurements exceed the norm: some tests migt show that the acceptable limits are exceeded as much as 20 times, as opposed to 400-500 times in the early 1990s. Nesterenko offers an example of retired residents who relied heavily on dried mushrooms in their diet; dried mushrooms would have the level of radioactivity of about 800,000 Bq/kg. In Nesterenko's words, "this is fuel for a nuclear reactor."

Belrad also insists on control levels that are lower than state maximum acceptable levels (Babenko 2003, 7). Again, Belrad experts are doing a kind of dose alignment: state levels do not include external exposure in calculating thresholds of permissible food contamination. Suggested control levels correspond to the results of Bandarzhevsky's work, who demonstrated functional defects starting from a rather low accumulation of 50 Bq/kg (see chapter 4).

The second type of aligning of formalisms—closely related to emphasizing and analyzing results of actual measurements—is the work of critically assessing the internal consistency of the radiation protection formalisms by cross-checking different norms and levels (as they manifest themselves in the actual conditions of contamination). The work includes cross-checking correspondence between different thresholds or norms (formalisms), exposing the logic of thresholds and acceptable levels, and comparing to international norms. The general question is how different formalisms relate to each other and how they work in practice. In part, this is work of 'unblackboxing,' but in this case 'uncovering' of the context and logic of thresholds also emphasizes aligning different formal representations, and aligning formal representations with empirical data measurements.

I have already described Vasilii Nesterenko's commentary on the new concept of radiation protection. Other examples include Nesterenko's report Chernobyl Catastrophe (1998). Nesterenko criticizes the claims that current maximum acceptable levels for radioactive contamination of food products are too high in Belarus compared to Western levels (these are "theoretical" limitations in the West, and these are actual cases/accumulations in Belarus). Comparing across different levels leads Belrad to argue for establishment of additional levels of protection, such as dose burden limits for children (Nesterenko 1998).[160]

---

[160] Nesterenko argues that the levels of contamination in children's food are set to 37Bq/kg and the dose coefficient is three-four times higher for children; consequently, the dose limit should be set to 0.3 mSv/year.

***

This chapter has discussed mis/alignment of formal representations and other kinds of production of in/visibility as work that can only be done by experts (from particular technoscientific and bureaucratic positions) and that is essential to making imperceptible hazards publicly in/visible. Formal representations and the production of invisibility through them is a particularly complex area for social analysis; part of the challenge is that dialogical and structural contexts of this work are already partially obscured. This chapter focused on explicating and elaborating connections between expert work of making visible and its broader structural and dialogical contexts in the post-Chernobyl circumstances in Belarus. Most importantly, through analysis of formal representations, this chapter has linked articulation work (and I emphasized dialogical, relative aspects of it) and work of creating and sustaining infrastructural solutions. Interconnections between infrastructural work and articulation will be further explored in the next two chapters, focusing on the laypeople's perspectives, and they will be the elaborated further in the conclusion.

# Chapter 6.

# In Dialogue with the Affected Populations:

# Living with the Invisible Hazard

The previous chapters have described how visibility of the Chernobyl problem has been manipulated by the international organizations, state government (in the media and in its management of state science institutions), and local experts. Visibility of 'Chernobyl'—public recognition of the presence and scope of contamination—has been expensive for the Belarusian government and, lacking international support for recognizing and addressing Chernobyl-related consequences, the Belarusian government began, in the mid-1990s, the politics of reframing 'Chernobyl' as an economic problem and emphasizing socio-economic rehabilitation of the affected territories. This chapter is concerned with perspectives of the people who, two decades after the accident, continue living on these territories.

When the official position in the media claims that the territories are soon to be completely rehabilitated, do the laypeople still care about radiation danger? Or, in the words of the official media, "have they gotten used to radiation" because "you cannot live in fear all the time"? The chapter has a dual goal of attempting to answer these questions and addressing theoretical issues regarding how populations living with lasting invisible hazards perceive the danger and act to reduce it.

The theoretical approach offered in this chapter accounts for multiplicity and variability of local *perspectives* on radiation danger, including perspectives that show indifference to radiological advice and overall disregard for the problem. The chapter makes the following arguments in order to address this multiplicity and variability of perspectives. First, individual risk behaviors and individual perceptions of radiation danger are interpreted as particular to specific local contexts and as affected by a number of structural factors. The paradoxical fact about Chernobyl radiation is that, two decades after the accident, the internal accumulation doses are individuals' own making: the state food infrastructures have entrance and exit radiation control, and individuals create their internal accumulations of radionuclides by consuming contaminated foodstuffs from private plots and from forests. The chapter argues that people make their doses but not in the circumstances of their making; these circumstances present a unique intertwining of radiological, geographic, economic, cultural and other factors. Forests, which could be described as a "natural" resource, are integrated in the system of structural factors that result in greater internal accumulations for the most economically disadvantaged groups.

The second argument is that individual and group perspectives reflect particular temporal and spatial relationships to perceived radiation danger. Perspectives of the populations living on Chernobyl-affected territories are shaped by the fact that the problem of contamination of their environment is continuous. Temporality of the problem can be juxtaposed with temporality of information exposures, and possible individual and infrastructural responses. This analysis raises the issue of the *work* of following radiological advice. Attention to different temporal and spatial positions with respect to "radiation danger" also highlights different interpretations of the extent of the past, present and future danger. The variability and complexity of these understandings cannot be contained by the experts' notion of "risk" (which generally refers to an adverse *event* in the *future*). One of particularly revealing cases here is when individuals are both indifferent to radiation protection measures and concerned with radiation health effects.

The chapter is based on interviews with radiologists, residents of three of the "affected" districts, and representatives of other groups of the "affected populations." The interviews are supplemented with data from studies by Belarusian scientists to add broader and more systematically-described context. Radiologists working with local populations in the Chernobyl-affected regions generally represent a narrow group of experts; the chapter relies particularly on interviews with Minsk-based radiologists from Belrad Laboratory for the Spectrometry of Human Radiation who have been traveling frequently to all of the affected districts since 1996. In addition to Belrad radiologists, the chapter relies on an extensive interview with "Aglaya," a radiologist from a Local Center for Radiation Protection in one of the "difficult" villages in Stolin District,[161] with her unique and valuable experience of having worked as a local radiologist since 1991. Interviews with local residents were conducted during my trips to several affected districts with Belrad radiologists and with members of the CORE project. Personal stories used at the end of this chapter were collected during individual interviews in Minsk, Gomel, and Khoiniki (see Appendix. Data and Methodology). All the names of the villages used in this chapter have been changed, but the text preserves original names of the districts, since the affected districts vary greatly in their social and radiological circumstances. The next section offers a theoretical discussion of the concept of

[161] Post-Chernobyl contamination is "spotty"; territories of one district are contaminated very unevenly. Aglaya's village has higher level of contamination than neighboring villages.

“perspectives” and its use to describe views of the affected populations, followed by description of Chernobyl-specific circumstances in the rest of the chapter.[162]

## Multiplicity of Perspectives of the Affected Populations

The international reports discussed in Chapter 3 describe "the affected population" as anxious about living with increased levels of radiation (so anxious that they produce psychosomatic reactions), fatalistic about the effects of radiation, and overwhelmed by the socio-economic problems and poverty. According to the World Bank report on Chernobyl consequences in Belarus (2002), "only a negligible portion of households test food for concentration of radionuclides." Overall, people are more concerned with socio-economic problems than radiation. A study by the Belarusian Committee "Children of Chernobyl" (2004a, 2004b)[163] argues that the "affected population" is aware of the contamination of their foodstuffs, but does not do anything to improve the situation; often people do not know techniques for growing ecologically clean produce. According to the study, some of the residents claim that there is nothing you can do “against radiation” and it is useless to try to take any measures; others say that it is very costly and they do not have the means. A popular quote from this study describes the population living on the affected territories as thinking that: “I would rather die from radiation than from hunger.” In contrast to these reports, members of the

[162] In the attempt to investigate perspectives of the populations currently living on the contaminated territories, the analysis focuses on this group and not on other groups of the affected populations, including resettlers and liquidators (Chernobyl clean-up workers). The argument made at the end of this chapter—that individual temporal-spatial trajectories and current positions with respect to "radiation danger" affects individual interpretations of “danger”—implies that these groups and individuals would have their own, unique perspectives, but this study does not discuss them in detail.

[163] The study was conducted as part of the International Chernobyl Research and Information Network project to study “the information needs” of “the affected population” (see chapter 3).

international projects working in the contaminated areas typically hesitate to give one coherent description of the "affected population" and instead emphasize that "the range of opinions is very broad, from concern to absolute indifference."

Applied international projects, such as the CORE (CO-operation for REhabiliation of living conditions on the affected territories) Programme or ICRIN (International Chernobyl Research and Information Network), aggregate different groups together into a single "affected population" category and use the "stake holder" model to represent them. Kim Fortun (2001) describes the assumptions of this model: the affected populations are interpreted as "epistemologically homogeneous and epistemologically consistent"; the views of this population appear to not change over time; and these views are irrational, as well as "subjective, intuitive, and experiential" (2001, 11). [164]

There are no grounds for a priori assuming that there is one homogeneous "affected population." [165] Fowlkes and Miller (1987), in their description of the community of Love Canal and its residents' perceptions of the hazard, note that the community did not exist as such prior to the hazard; it was shaped by the situation itself – within the officially defined territorial boundaries. The community was also divided from the onset: some residents were "minimalist" in their definition of danger; others were "maximalist." According to the authors, these views corresponded to individuals' "life-cycle" factors and occupation. "Minimalists" were predominantly in or near retirement

[164] In her own analysis, Fortun (2001) proposes a more flexible and sophisticated model of "enunciatory communities" to describe advocacy after Bhopal. The focus on potential indifference and lack of mobilization on behalf of the affected populations makes it difficult to adopt this model for the current analysis.

[165] Assumption of epistemological homogeneity of the affected populations could be based on presupposing that these populations share "common experience" (see the next chapter) or common interests. It could also be based on juxtaposing "laypeople" to more coherent, institutionally defined, groups of scientists or government officials. In the later case, laypeople might be defined by their "lack" of expert knowledge and their presupposed dependence on expert advice.

and had no children living at home; some of the "minimalists" were also employed at local chemical facilities. All parents of young children, on the other hand, were "maximalists" in their views. The role of socio-demographic factors, different risk exposures and experiences has been noted by other researchers as well (e.g. Powell at al. 2007). Fowlkes and Miller argue that these factors “do not cause beliefs but influence the *perspective* from which individuals collect information and evaluate experience” (1987, 61). These “structural” factors might “encourage desire for evidence in the first place” (e.g., some of the minimalists were intentionally uninformed), but creating one's coherent perspective on danger is an interpretative and interactive process (which includes interaction with scientists). Importantly, both minimalist and maximalist positions are described as “simultaneously and equally rational,” i.e., rational according to their interests and situation (1987, 72).

The present analysis adopts and expands this view of the “structural factors” and individual interpretations of ongoing, invisible hazards. The concept of perspectives refers here to narrative interpretations offered in *particular dialogues* and in *particular local contexts*. *Socio-demographic factors*, as well as individual (or group) *temporal and spatial trajectories with respect to “radiation danger”*[166] affect the perspectives they adopt regarding where, when, and what the danger is.

My interpretation of “perspectives” relies on the dialogical approach (Bakhtin 1973, 1981; Kuchinsky 1988; Wertsch 2002). Perspectives are, strictly speaking, not "individual." Individual opinions 'echo' established social perspectives (as has been

[166] The quotation marks are used to indicate the highly constructed character of the hazard and its effects. Properly speaking, “radiation danger” refers to representations of this hazard through formal representations (see chapter 5) or narrative descriptions.

demonstrated in studies on collective remembering);[167] tensions between this 'echoing' and what is unique and individual in these expressions is irreducible. In the contexts of particular public dialogues, people are familiar with *a number* of different perspectives, and can provide a meaningful account of how, for example, radiation is more or less dangerous, depending on the context and who they are talking to. In other words, *most people can and do change their perspectives in different dialogues and different practical circumstances* (coherence and stability of individual perspectives should not be assumed a priori). For example, the same person might argue that Chernobyl has had 'grave health consequences' in one context (e.g., claiming Chernobyl benefits, teaching children, or talking to local administration) and assume a position of indifference in one's daily life. This insight—that individual perspectives are not necessarily stable—will be important in the analysis of how people living on Chernobyl-affected territories interpret the hazard and what they do about it.

At the same time, though a person can hold many different perspectives, only one perspective can be enacted at a time (in this sense, practical activity is mono-logical).[168] An individual can go back and forth between following radiological advice or not following it, but at any given moment, there is only one thing that can be done. An

---

[167] Research on collective remembering offers examples where individuals are assisting each other in better reconstructing particular perspectives or arguments, and are indeed switching between different perspectives as they do so. Michael Billig (1998) offers an example in his discussion of collective remembering, where individuals (members of an ordinary British family) are *jointly recreating positions* for and against a particular topic (in that case, the role of the British Royal Family). On a more basic level, James Wertsch (2002), building on Mikhail Bakhtin's theory, shows that narratives of collective remembering always reflect not only the authors' voices and who they address, but also many *others,* who have used these words and made these statements before. In the words of Bakhtin, these are "the voices... heard in the word before the author comes upon it" (Bakhtin 1981). The 'echoing effects' of individual statements about Chernobyl was extremely noticeable in my interviews with laypeople and with certain experts. Individual judgments in these cases had recognizable 'tunes' or sentiments.

[168] One's actions can, however, be reinterpreted retrospectively.

individual can choose to relocate or not to relocate—one perspective becomes dominant at a given moment in time, in a particular practical activity—but this should not mean that an individual is not aware of or does not hold other, perhaps competing, perspectives, which could become salient under other circumstances. The primary focus of this chapter is on individuals' radiation-related actions, but they cannot be meaningfully separated from how individuals interpret the circumstances and what they think about the danger.

As has been argued in the introduction, perspectives mutate historically, with the unfolding of public discourses and changes in historical circumstances. Perspectives do not just change with time; they reflect these transformations and histories. Thus, perspectives collected eighteen or nineteen years after the accident differ from those described by earlier oral histories of Chernobyl (e.g. Alexievich 1999). [169] Evident in them are the past efforts of "educating the public" about radiation danger, state Chernobyl policies, and popularized scientific perspectives.

To summarize the theoretical discussion so far, "the structural factors," as well as one's position with respect to the radiation danger itself, affect the perceived scope and character of this danger. For somebody sufficiently removed from the context, anywhere in Belarus might be "near Chernobyl," whereas local residents might describe contamination on a different scale (e.g., "that forest" but not "that pasture"). Svetlana Alexievich writes in her book based on a collection of interviews with those whose lives were directly affected by the Chernobyl accident: "In Minsk, it is one Chernobyl, in the zone - a different one. Somewhere in Europe yet a third one" (1997, "In Place of

[169] Narratives collected by the Belarusian journalist Svetlana Alexievich (1997, 1999) are focused more on dealing with a recent accident than living with radiation danger; they show much confusion and grievance.

Epilogue”). Alexievich points out the astonishing indifference with which people living 'in the zone' talk about it; it is just their normal life. The paradox that those who live on the affected territories are not necessarily the most concerned will be explored in this and the following chapter.

The next section explores how individuals accumulate their internal doses. Local experts typically consider internal exposure as particularly dangerous, especially since cesium-137, the major source of contamination, tends to be accumulated in the vital organs. My argument, again, is that individuals make their doses ‘not in the circumstances of their own making.’ The section explores the intertwining of "structural," "natural," radiological, and cultural factors that create the dose circumstances.

## “Gordian Knots”:

## Radioactive Forests in the System of Socioeconomic Privilege

The affected regions are mostly agricultural and facing serious socio-economic challenges. Most enterprises do not profit; the regions are subsidized from the state budget; and there is a continuing rise in unemployment, especially among young people (Belookaya 2004a, 2004b). With some notable exceptions, personal business ownership and farming are not developed; the local residents attribute this to the lack of effective state policies, lack of adequate law base, and unstable state economic conditions (Belookaya 2004a, 2004b). People get by with low wages; private plots are maintained to supplement family diets and, in some areas, produce is also sold for additional income.

Private plots and privately owned cattle *become* the source of radionuclides through several “radiological chains” (paths of migration of radionuclides).

Radionuclides are accumulated in the top layer of forests and fields; cattle consume them while gazing on wild pastures (as opposed to "cultured pastures" purposefully planted with special kinds of grass that does not accumulate radionuclides); people consume radionuclides with cattle milk or milk products, and contaminated cattle-dung used as a fertilizer further contributes to contamination of the private plots. Similarly, use of forest wood in furnaces makes them 'private reactors,' and then ashes are also used as soil fertilizers. Gathering forest mushrooms and berries is overall a popular activity in the country, but it acquires particular significance in the rural areas where it is a major free supplement to family diet. Fishing and especially hunting could be another major source of internal accumulations. Privately grown or collected foodstuffs are also sold on local markets.[170] To summarize, while levels of radiation in the state food production infrastructures are monitored, individuals' own practices result in their increased internal accumulations of radionuclides.

A number of interrelated factors come into play within this general picture: patterns of radiation fallout and specific local circumstances (e.g., types of soil,[171] predominant forests or fields), the size of the locality, comprehensiveness of previously taken decontamination measures, socio-economic status of the residents, as well as local cultural and socio-economic traditions. The role of different factors and interplay between them is *unique to each individual locality*. In this sense, 'contaminated community' (Edelstein 1988) might be described as a constellation of situated

---

[170] Most of food markets have centers for radiation control; individual sellers are required to have their produce tested and to have and be able to show certificates from these tests to buyers. However, sellers could potentially be selling both clean and contaminated foodstuffs, manipulate which of their foodstuffs are tested, or lie to buyers regarding which areas their produce is from.
[171] To oversimplify, different types of soil allow for different rates of “natural” migration of radionuclides from soil into plants.

communities, with their own unique radiological, social, economic, political, and infrastructural networks. Below I describe some of the key factors in more detail and provide examples illustrating the interplay of these factors in some localities.

**Forests and Private Plots: Economic Resources and Sources of Individual Doses**

The relationship between the size of the locality and individual doses of internal radiation is described by A.M. Skryabin (1997).[172] Smaller villages tend to be worse off in terms of their socio-economic conditions, and their residents rely more heavily on private plots and on forests. The size of locality also correlates with the scope of the decontamination measures taken after the accident: the larger the town, the more comprehensive the measures. Consequently, individual doses of internal radiation in small villagers are two, three, and up to five times higher than in district centers (towns). The relationship has been observed for three out of four districts studied by Skryabin; the exception, Narovlya District, is discussed below.

Skryabin also offers an example from an earlier period, when the state was imposing limitations and prohibitions on the use of forests and consumption of produce from personal plots in particularly contaminated areas. The limitations were not as effective in small villages and especially villages located further away from local centers (Skryabin 1997). Residents of these villages went back to consuming milk from their cattle faster than residents of larger villages, and the cut-back was generally less than 30% (as opposed to 70-80% in larger localities). The effectiveness of prohibitions on use of forests was even less noticeable. Though Skryabin does not say it explicitly, there are

[172] Internal accumulations in the study have been measured with whole body counters (WBC)

simply fewer infrastructural and economic resources available in smaller villages; there are also fewer young people and children living in smaller and remote villages. Skryabin interprets his data differently: the problem is that the measures were imposed top-down and they went against the local "way of life" and "customary" reliance on forests. Threats to cultural identity are a known factor influencing individuals' radiological behavior (Paine 1992). However, in this case, “tradition" would appear to also mask socio-economic necessities and lack of adequate infrastructures in rural, remote places.

**Unique Local Constellations of Factors**

In Skryabin's study, one district, Narovlya, showed no difference between internal accumulations of the residents depending on the size of locality. The district is immediately adjacent to the zone of exclusion around the Chernobyl nuclear plant, and is infamous in terms of individual doses of its population. Personnel of Belrad Laboratory for the Spectrometry of Human Radiation note that, out of three thousand children living in the district, “more than 95% have more than one chronic diagnosis.” The head of the laboratory uses the Soviet category 'practically healthy': “there are no 'practically healthy' children in Narovlya District, they all have diseases.” According to Belrad radiologists, other contaminated districts typically have two or three “difficult” villages with particularly high internal accumulations, but even in the most “difficult” districts (e.g., Chechersk District), there are villages that are relatively “well off.” In Narovlya District, all of the villages are "difficult." According to the Head of Belrad Laboratory, “any village there is huge numbers [of internal accumulations, measured on whole body counters (WBC)]" (for more on WBCs, see chapter 7). He relates it to the character of the contamination itself and abundance of forests.

Narovlya is a particular case, but there are significant differences between other districts and localities as well. The nature of these differences, again, points to the tight interconnections between radiological, economic, and cultural factors. For example, Olshany village is located in the "difficult" Stolin District. This is one of the most densely populated districts, which results in the deficit of cultured pastures, and consequent higher levels of milk contamination. Olshany, however, has been less radioactively contaminated and it has unique cultural and socio-economic traditions. The village is sometimes referred to as the "cucumber capital of Belarus"; its economic well-being is observable even in the types of houses (cottages) in the village, which stand in great contrast to houses in neighboring villages (there are also numerous cucumber 'hotbeds' in-between the houses). According to Belrad radiologists who have measured about 900 children there, "the numbers are all under 30 [Bq/kg]. There are much fewer problems." Islands of strong entrepreneurial (farming) traditions appear in several other locations in Dribin and in Vetka Districts (Belookaya 2004a, 2004b).

The town of Bragin represents a radically different set of circumstances. It is located in the area with higher level of contamination (15-40Ci/km$^2$ or 555-1480kBq/m2), and it has been largely re-populated after the accident. Significant parts of the town population, including the most educated groups such as doctors and teachers, left the town after the accident. Over the years, new residents came to live there, including refugees from other former Soviet republics and, in the words of one Chernobyl expert, people "with complicated life circumstances." The refugees came mostly from

Kazakhstan and the Caucuses, fleeing unstable, often war, conditions in their homelands. Many of them are families with a number of children, often with low economic status and relying on state subsidies for children (Belookaya 2004a, 2004b). Another particular group is former residents of the 30-kilometer zone around the plant who were evacuated in 1986, often to other contaminated areas.[173] Many live in houses that were built in a hurry and inadequately, and only few have jobs (Belookaya 2004a, 2004b).

The most affected areas typically have striking demographic "profiles." Some areas of evacuation and resettlement are populated mostly or even exclusively with elderly retirees who did not want to leave their homes or returned there. Young people, on the other hand, often did not want to stay and still do not want to stay on the contaminated territories for long. [174] They often lack basic social security—housing, employment, and stable future prospects—and, at the same time, they are typically more knowledgeable than other groups about radiation danger (Belookaya 2004a, 2004b).[175] This results in unique demographics in some areas, and, and lower birth rate there (Belookaya 2004a, 2004b).

[173] This was done in an attempt to "contain" the appearance of the accident (see chapter 1; see also Petryna 2002). According to Belookaya, the houses have such poor conditions that people get sick often. One study participant said that, "The ones who could, returned to their old places" (Belookaya 2004a, 2004b).

[174] Belookaya's study (2004a, 2004b) argues that 73% of its participants, all residents of the affected territories, would not want their children to stay in these regions, which they relate to radiation and low level of life. "Fate has it that we live here, but our children do not have to"; "Children should not live here, there is no hope for the future, no attention to our problems from the side of authorities."

[175] In 2005, the Belarusian government expressed concerns about the ideological influence of the health rehabilitation trips abroad for children from the affected territories and suggested that international humanitarian organizations instead sponsor children's rehabilitation within Belarus.

**Individual Doses and Structural Factors**

The argument that individuals make their own doses was made by A.M. Skryabin (1998). [176] In his interpretation, individuals' personal characteristics determine their radiological risk behavior and, consequently, higher or lower internal accumulations of radionuclides (Cs-137). The subjects in his study were tested with a whole body counter (WBC). Based on these tests, they were divided into four groups depending on the magnitude of their doses. Skryabin reports that 'the small dose' group was dominated by women (80%) and 'the high dose group' by men (75%).[177] The 'small dose' group consisted mostly of white collar workers and housewives; the 'high dose' group was predominantly manual workers and retirees. According to Skryabin, radiological risk behavior is a matter of bad individual lifestyle choices. [178] This section considers socio-economic, occupational, and educational differences in more detail; I interpret them in particular local contexts. The next section, however, will discuss why this type of data

[176] The sociological "advantage" of describing individual risk behaviors in the context of post-Chernobyl radiological contamination is that the differences can be measured "objectively" with measuring people's internal radiation accumulations, i.e., radionuclides that have been consumed with food.

[177] Powell and her co-authors (2007) summarize results of previous studies (for Western contexts) arguing that women are more likely to be concerned about health risks.

[178] Anatolii M. Skryabin describes psychological and lifestyle characteristics of the two groups with the highest and lowest accumulations. He argues that the level of 'neurostenization' and anxiety was three to four times higher for the 'small dose' group than for the 'high dose' group. In the 'high dose' group, every fourth person was a chronic alcoholic, compared to none in the 'small dose' group. Much like the Soviet nuclear experts and experts of the International Atomic Energy Agency (see chapter 3), Skryabin argues that high levels of internal accumulations are a matter of bad *individual lifestyle choices*. Since, however, he considers doses to be generally too low to cause any health problems, he also argues that *anxiety and hysteria* related to unnecessary "excessive" concern with radiation is ultimately more harmful for individuals.

This psychological approach is consistent with Skryabin's views on Chernobyl radiation effects as insignificant (*Gomel'skaya Pravda*, 25 Apr, 16 July, and 19 Nov 1992; 25 and 26 Apr 1996) and his personal expert position. Skryabin has worked at the Soviet nuclear sites prior to coming to Belarus in 1986 at the invitation of the Minister of Health Care. He was one of the supporters of the infamous Soviet "35 rem" conception of radiation protection (see chapter 4).

Blaming individuals' lifestyle choices is a familiar strategy used by industry-related experts in cases of environmental exposures (Proctor 1995, 125-132); chapter 3 has discussed nuclear experts' strategic deployment of the "psychological" theories of the affected population.

(and, consequently, psychological or structural explanations based on it) does not fully account for the changing behavior of the majority of people.

Radiologists of Belrad Laboratory for the Spectrometry of Human Radiation have been conducting WBC tests of internal accumulation of radionuclides in children since 1996, [179] and in their experience, well-being of the family and their socio-economic status is reflected in children's doses. The head of the laboratory describes the relationship in the following way:

> We noted a long time ago that whether or not a child has significant accumulations, how he feels, how he behaves – it depends on the social and economic status of the family. First, we were only noting it. Then we started asking social pedagogues [a kind of school psychologist]. We approached them before doing the measurements in schools or while doing the measurements. A social pedagogue has lists: children from poor [*maloobespechennye*] and at risk [*neblagopoluchnye*] families. So for example, village Y in Chechersk District we make tests there eight times a year and the top ten is always the same; year after year, it's the same children who have the "top numbers."

Cases from Belrad experience illustrate the influence of various social, especially socio-economic, factors (see cases 1-4 below). The role of these factors can be illustrated with cases of particularly high doses. The examples describe accumulations of thousands of Bq/kg, including in children, when the Belarusian Ministry of Health estimates the acceptable limits to be in the range between 361-433 Bq/kg (depending on age) (Babenko 2003). Belrad's own recommendations suggest that internal accumulations do not exceed 200 Bq/kg, with the control level 70 Bq/kg. How these extreme doses are accumulated points to the same group of factors: forests in combination with low socio-economic

[179] For more description of Belrad's work, see chapter 5. Belrad and its Laboratory for the Spectrometry of Human Radiation were the only place where I could find these cases, both because of the extensive experience and data collected at the laboratory and because of its general accessibility (as opposed to state radiation protection infrastructures). In the period 1996-2005, Belrad radiologists have conducted more than 290,000 tests (Nesterenko, personal interview). Most of the tests have been conducted with children, both because they are the group most vulnerable to the effects of radiation and because of the relatively easy daytime access to them at school (during the school year).

status of families. Children whose diet included foodstuffs gathered in forests had the highest accumulations, as in Case 1. Case 2 describes a family with no private plot; their dependence on free forest goods is particularly significant, and the father of the family is especially oblivious to radiological advice.

This case can be contrasted with cases where the parents do "pay attention." According to the head of Belrad Laboratory, in the later case, children from the same village would have accumulations of (only) "15 or 20 or 25 Bq/kg." When Belrad radiologists are conducting WBC testing in local schools, including kindergardens, children are often too small to understand the radiation protection advice themselves, but some of the mothers would "wait for the tests, then ask about the results, ask if they are high or not, what is the best thing to do. She would find it all out and she would follow our recommendations and advice. She does it and then we see the outcome." The WBC tests of these children show lower numbers. According to Belrad radiologists, there are "not a lot of people like that, but there *are* people who do it."[180] These are often local "intelligencia," better-educated local residents. According to the head of Belrad Laboratory, "Besides knowing what to do, they also want to do it – they want to grow healthy kids. So once they find out, they are trying to do it." The contrasting Case 3, however, demonstrates that there are examples of educated, well-to-do persons with high doses.

[180] As will be discussed below, following radiological advice is a question of work and resources, including time and financial resources.

**Socio-economic factors and the role of forests: cases from the experience of Belrad radiologists (transcribed in full from interviews)**

**Case 1. No Private Plot and Forest Use**

Village X in Bragin District. Three children from the same family. They don't have a [private] plot. The children are always in the top ten [dose accumulations among children in their school]. There are two other brothers, from a family that deals vodka, they also don't have a plot. So since there is no plot in the family, -- and it particularly applies to teenagers, [who are in ] 7th, 8th, 9th , 10th years of school – the children want to eat, so they go gather mushrooms, or they go fishing, or they go with hunters. They basically eat whatever they can find. And their number is correspondingly large, 4,000 Bq/kg. There are similar stories in Bragin District, and practically everywhere else.

**Case 2. The Highest Doses**

The highest doses we found were in village Y in Narovlya District, in 2000. The family has five children; their father is a hunter. Drinking vodka and hunting is all he does – instead of planting potatoes. Even in those conditions, it is possible to grow rather clean produce on treated soil; you can do it. But the man goes hunting, drinks '100 gramm' [a shot of vodka] there, brings game home, and is even probably proud of it. He does not understand that what he feeds his children is poisoning them. The children had 7,500 Bq/kg.

**Case 3 (contrasting case). A Doctor with the Highest Dose in the Village**

Village Z in Elski District. The [case of the] highest accumulation there was a doctor, the chief physician of the local hospital. You would think that if somebody knows about the [radiation] danger and how to avoid it, it would be him. It turned out that he loved hunting. Naturally, after you get a trophy, you want to have some of it. At least he had enough sense not to give it to his children. The children did not have high accumulations. He just stopped caring about himself. Even though he was only thirty, a young man.... [*O.K.:* Do you think he is doing this because he does not feel the consequences?] He does not feel them *yet*.

**Case 4 (contrasting case). A Woman Who Loved Forest but Had a Small Dose**

A woman, headmaster of a school in Chechersk District. She loved forest – so much that she even wrote a will to be buried in forest. So when she sat down in the 'chair' [whole body counter (WBC)], all the teachers came running: now they were going to see some large numbers. But she only had 15 Bq/kg. Everybody was asking: how come? She said that she only *walked* in forests, she did not pick up a single berry or a single mushroom since the late 1980s.

Case 4 points to how much the past radiological information has been "internalized" by the local residents: radiological contamination of local forests, the danger of eating mushrooms, and similar issues have become almost common sense. Whether or not these laypeople's conceptions are interpreted as scientifically "correct" depends on what expert perspective sets the criteria. The head of Belrad Laboratory argues that internal exposure accounts for 90-95% of the overall dose,[181] and that it is more dangerous than external exposure: "With external exposure, you come there and you get exposed, but then you leave and the exposure stops. If you get radioactive substances with food, they are inside the organism and are constantly irradiating from inside, which is more dangerous." Regarding the woman in Case 4, the head of Belrad Laboratory argues that the background radiation in her forests is "not that high. Up to 50mR/hr. It's not that much." The woman herself clearly knew not to ingest forest mushrooms and berries (more detailed discussion of how individuals interpret radiation danger is offered in the next chapter).

Socio-economic factors and individual interpretations of radiation danger are intertwined in even more complex ways in the Cases 5 and 6. Children's Chernobyl-related health recuperation trips abroad, [182] organized by international humanitarian foundations or NGOs, are both a rare and unique opportunity to travel outside of the country and they typically come with such 'perks' as presents for the children from their hosts. Case 5 illustrates a particular interpretation of radiological danger versus the health and economic benefits of these trips (the case could be interpreted as a *lack of fear*

---

[181] Regardless of what percentages of the overall dose is attributed to internal exposure, the Belarusian experts typically agree that internal exposure is more dangerous and that the doses two decades after the accident are significantly lower than they used to be even in the early 1990s.

[182] *Health recuperation*—temporary residence (vacations) on "clean" territories with corresponding consumption of "clean" food—was introduced as a prevention measure in the 1989 *Program of Liquidation of the Consequences of the Chernobyl Catastrophe.* The goal was to decrease exposure doses for the populations residing on the contaminated territories. Its adoption as a public health measure was related to the practical impossibility of providing residents of the contaminated areas with clean foodstuffs. The problem with the practice of health recuperation appears to be that the doses are re-accumulated soon after children (or adults) return to their places of residence and their usual diet.

Belookaya's study (2004a, 2004b) describes current negative attitudes of the affected populations towards "forced" health recuperation for schoolchildren during the school year (children travel to recreational facilities in other parts of the country). Children's health recuperation trips abroad are generally viewed in a more positive light. The scope of the effort by international non-governmental organizations and humanitarian foundations to organize these recuperation trips for "Children of Chernobyl" has been truly unparalleled (see chapter 3).

*of radiation* where perhaps there should be more). Case 6 provides a contrasting example where radiological and socio-economic concerns are not in conflict.

**Socio-economic factors and interpreting the radiation danger: cases from the experience of Belrad radiologists (transcribed in full from interviews).**

**Case 5. A Scandalous Case of Consciously Feeding Children Contaminated Products**

This is a horrible case. I am not going to name the village. We were selecting children with large accumulations to go to Ireland for rehabilitation. In one village, they learnt about it through their local radiation control center and started bringing foodstuffs to get tested. Usually, they did it rather laxly, but now started bringing foodstuffs quite a bit. They were consciously giving "dirty" products to their children [so that children "qualify" as having large doses and go to Ireland].

They think that a month or three weeks in Ireland is a solution to their problems. The child will be happy and healthy. But this is far from the case. The harm that they have caused their child before the trip will not be compensated by the trip itself. We had one case like that. It ended up with a big scandal. The local authorities got involved.

**Case 6 (contrasting case). Living on Aid, but Responsibly**

Another approach. One village has a family with nine children. The windows in the house are taped instead of glass windows. The head of the collective farm tells the man, the owner of the house, "I'll give you glass, put it in." But he does not want it because the Germans are going to come [bringing humanitarian aid] and they are going to ask who lives there. Oh, that's a family with nine children. They are poor [too poor to even have glass windows], they need help. The Germans bring money, presents. Presents are sold the same day by the local store. But when that man brought his children for [WBC] tests... I have to give him that: he does not spend everything on his drinking [*propivaet ne vse*]. It was winter, and the children were dressed properly; you can't say that they had no warm clothes. So he has enough consciousness. The children did not have high doses. ... But he has an image of a sufferer, of a father of nine children. [O.K.: Does he work at the collective farm there?] He does not work anywhere. He lives off the presents. Everybody knows that family now, and they try to pass a gift or something when there is an occasion, send money, products.

Some of the cases described above are rather extreme examples of the lack of concern, the role of socio-economic circumstances, and the use of forests. These examples are not comprehensive; they only mark the poles of the spectrum. The next section continues exploring individual perspectives in local contexts, now emphasizing people's temporal-spatial relationship to danger. Radiation is a continuous problem, and questions arise regarding the work of following radiation advice over time.

## The Work of Living with It

Skryabin's study implicitly presupposes that radiation-related behavior of *the majority in-between the extremes* of the highest and lowest doses follows the same logic as that of the extreme cases, only to a lesser extent. A different perspective on the radiation safety behavior of the majority "in-between" has emerged from an interview with a local radiologist from Stolin District, Aglaya. She is well-known in the circles of the international Chernobyl projects, and the local center of the radiation protection where she is the one and only radiologist, established by Belrad in the early 1990s, is supervised by the Brest branch of the State Institute of Medicine). Aglaya has been responsible for drawing the attention of international projects to her unusually radiologically "difficult" village in a moderately-contaminated area.[183] Working as a radiologist is Aglaya's part-time position; her primary occupation is as a nurse.

When asked whether she thought that people just "have stopped caring" and "nobody did anything," Aglaya replied that:

> I would not say that people just don't care anymore. I've been doing it [radiation control and dealing with people around these issues] for a long time now, since 1991. I think there are three groups of people. The first group is educated people who listen to what scientists and doctors say, what is said in the newspapers. The

[183] Aglaya's village differs from other villages in the extent of attention from international projects that it receives. However, as described above, any specific locality has a unique constellation of factors, and Aglaya's description of her village is a good starting point for thinking about other localities as well.

> second group of people – and this is the majority of people – *become worried about radiation from time to time, when there is something that brings it to their attention*. For example, when there is a foreign delegation in the area dealing with Chernobyl issues or if there is something in the news... The third group of people is less educated; they just don't care no matter what. The first and the third group of people are rarer; the majority of people are in the second group. People who bring their foodstuffs to be tested are the first category, and the rest... *they do it from time to time, when there is an occasion*. When they get woken up, some test teams come or foreigners come.

Aglaya's description of "the second group," possibly the majority, as caring "from time to time" *when something makes the problem visible*, has been indirectly confirmed by the staff of Belrad Laboratory. Belrad has a number of local radiation protection centers—such as Aglaya's—in other contaminated villages; radiologists there are required to make a particular monthly number of tests of the radioactive contamination of local foodstuffs. They can also do more tests if needed. Belrad Laboratory reports receiving more test data from the local centers after Belrad experts have come to these villages with their mobile WBC to test internal accumulations. For a period of time, the residents bring more foodstuffs to be tested, and then the wave dies out.

Participation in radiation safety workshops organized by international projects has a similar waving response: first there is a surge in interest and participation, followed later by a decrease in participation. According to Aglaya, at the beginning, many people wanted to participate in radiation protection programs, such as courses for young mothers or pregnant women, or other programs similarly targeting life needs of particular groups of people. However, "you have to make an effort and devote time to it, so many dropped out. Only the most persevering stayed. It is much easier to work with them, and they ask questions [and want to know]."

Radiation protection activities—from having one's produce tested, to boiling meat in salty water for hours, or processing milk with skimming centrifuge (radionuclides remain in whey)—is work. Living on the contaminated territories means that this work would have to be constant, and, most importantly, their own private, radioactively contaminated meat or milk is often the only kind that the local residents have. Aglaya describes the complicated, almost pointless, nature of food radiation control from the perspective of the local residents: people "are going to continue living here, and continue eating these products. Nobody is going to bring them clean milk or berries; they won't be able to survive on the products they get from a shop. They will continue having products from their own plots." Aglaya acknowledges that people do not bring foodstuffs to be tested "when left to their own devices":

> People don't bring foodstuffs to be tested themselves, not much. When I go around collecting products, they cooperate. But some are skeptical: 'Are you going to give me money to buy new milk [if this is contaminated]? We have been eating it and will continue to eat it.' But generally I could always find an approach [to people], could always convince them and take measurements.

Women and men from Aglaya's village and a different village of the same district have similar attitude:

> I'll tell you for everybody. Nobody boils meat [for as long as they tell you to]. They just eat it as usual. Yes, radiation is something to worry about, but nobody does anything. At least, I boil mushrooms when I marinate them, the rest are not doing even that... I love mushrooms myself. Am I supposed to not eat them? If only you could take a pill that would take radiation out – I would be interested in that (a woman in her middle 30s, nurse).

"A pill" in this case would perhaps be the most *effortless* solution to the problem of radiative contamination.

> [*O.K.*: What do you do when you know that your milk has too much radiation?] Nothing. Not throw it away, of course. I love mushrooms, too. And my grandchild is three years old. I want to give him something yummy. Milk, other stuff, we eat everything, we don't look (a woman in her 50s, social worker).

> If you have money, then you can buy everything clean [food]. Apples are clean here.
>
> We don't boil anything, we don't do this. We've gotta live here.
>
> Who would do that [all the radiation protection measures]? Farmers never have enough time.

Artem, a CORE member, observes that people are concerned about producing clean produce not for themselves, but because they 'have to' in order to sell it; at the same time, he leaves room for other reactions:

> I have not heard that people want to grow clean produce because that is what they want to eat. They are more concerned about it because they want to sell it... As for themselves... I have not heard it, but I suppose it depends on the person. Some might think about it, some might not.

These women and men *are* aware of the danger and in many cases they do know what has to be done. Aglaya claims that it is important to keep on testing and making the information available, so that "they can at least choose the smallest of the two evils." According to her, "No matter whether people are willing to devote time to having their foodstuffs tested or not, it is important that—even if they do it just once—they still learn and they will know for the future." The situation has improved greatly since when Aglaya started working as a radiologist (Belrad radiologists also confirm significant improvement following the work of the two international projects in the village):

> People know now where contaminated places are. At the beginning, the first years [of her work, early 1990s] were particularly bad. People would bring milk and it would have a couple of hundreds or even a couple of thousands [Bq/kg], sometimes 2,500 Bq, when the norm used to be 111 and now is 100 [Bq/kg]. I asked them where they brought it from, and the information spread that way. ... The ones who do not know are the ones who never talked to me. There are people like that, too, who never once got anything tested. So I walk around the village myself, collect tests. And then tell everybody, some listen to it.

Aglaya acknowledges that collecting food samples to be tested is not always easy: "People say that they know already. They are not cooperating very willingly. They know where around here is radiation." After an international project started working in the village in the 1990s, one more radiologist was hired to help Aglaya (for a rather symbolic pay of $10/month), but the new radiologist found that "people sometimes tell you 'no' in a rude way." Aglaya says, "I have learnt how to deal with them. I know who is doing what, who works where, who wants what. So with some I tell them that it's important for their children, with others that they won't get hay." Indeed, even with greater awareness of what places and what products are more radioactive, there are still people who pick up berries everywhere:

> Radiation fell out in spots here, so the marshes that are further there are better. They fit within the [established contamination] limits. This is where I gather cranberries for myself and my family. But people pick up dirty cranberries too, everything is picked up everywhere. Nothing is left behind.

Aglaya has submitted a project proposal with an international organization to create a map of radiological contamination around the village, based on the results of her tests of the products.[184] When asked if she thinks there would still be people who, after looking at the map, would gather mushrooms or berries in the most contaminated spots (assuming less competition there), she says that this is "exactly how it is going to be."

At the same time, Aglaya insists on the importance of making radiological information available, even when there is a lack of initiative on the side of many local residents. The problem, however, is that the educational programs themselves are also

---

[184] She acknowledges that she would need help from experts converting the radiation doses in food products into background activity in the area (which in itself shows a good command of the relevant scientific knowledge). "In my mind," she says, "I see it all in different colors; each area would have its own number."

temporary. She describes all the information put out, including how to reduce radiation in milk (make cream, cottage cheese out of it), which is a specific local problem; there are booklets in the local medical center (*ambulatoria*). The programs seek to attract young people as generally more willing to learn and implement changes: "there is work with young people in the medical center, and at school teachers talk about it, too." But the programs are tied to an international project, and:

> When they leave, all of this will probably stop. So that's why I'm saying that it would be good to have these kinds of lessons at school on a permanent basis. Something like 'how to protect yourself from radiation' or 'how to live in these conditions' – I don't know what to call it. But just so people are not indifferent and that they are not neglecting these issues. Since I still think that radiation does its ugly job...

Not only people's responses, but also education and information programs are "wavering" while the problem is ongoing. Aglaya's solution is to suggest to "infrastructure" these programs, to make them permanent—"since we are living with this kind of problem." Children's education at school acquires particular significance: "If children had those lessons at school, they would teach their parents, and then they would know when they become mothers themselves. If schools had those kinds of lessons, with their own teachers, with a set curriculum..."

With an ongoing problem of this scope, individuals—even when well-informed and willing—cannot solve it by themselves. Education of children is not the only thing that requires organizational or administrative attention. Organization of the measures on the scale beyond individuals is necessary, and often it can only be done through local administrations. Focusing exclusively on teaching laypeople the radiation protection measures is, in some cases, similar to asking the affected populations to do all the work and bear all the costs, and also asking these populations to do the kind of work that is in principle beyond what individuals can do. A commonly mentioned example is an organized removal of ashes (since they are particularly radioactive), which is a recognized need but is seldom done. People are advised not to use ashes as fertilizer or throw them out, but instead to bury them outside of their gardens. As one local resident put it, "For all these years, imagine how many 'tombs' I'd have around here?"

The necessity of infrastructural solutions is apparent already at the level of making them visible: measuring radiation in food and in humans cannot be done with relatively cheap and portable "geiger-counters"; it requires expensive and maintenance-heavy equipment; and it consequently has to be organized on the administrative level for the whole locality or district.

Aglaya brings up administrative solutions when she talks about "over-the-top" contamination of foodstuffs in the early 1990s and about how people gradually "learnt":

> [When people brought very radioactive milk,] I asked them where they got it from, and the information spread that way. I told them that they have to demand that their hay was changed to clean. Now the state is more cooperative, it is easier to get cultivated pastures and there is less wild hay. But there are still shortages. If somebody does not work in the collective farm, they might not get it either. Or somebody who has many cows... So it happens that people are still stocking up wild hay.

Local administrations, however, are often resistant to taking on additional problems and financial burdens (Belookaya 2004a, 2004b). For example, Belrad radiologists conducting WBC tests as part of the "Forgotten Villages" [185] project met with resistance in at least one district administration. Belrad staff contacted several

[185] As part of this project, Belrad radiologists measured internal accumulations for the residents in the villages that had been categorized as no longer radioactively contaminated and excluded from the catalogue of the affected localities. Consequently, people lost their Chernobyl benefits and compensations (see chapter 5).

district administrations, asking to confirm their agreement to cooperate and assist in organization of the tests. Mozyr District administration were distinctly discouraging:

> We were told the following: people have made some noise on that topic, we've calmed them down, so don't disturb our people. Don't come here, we do not need this. Everything here is good, everything is clean, everything is calm. Why this reaction? If there are problems, it means that they should be benefits which have to be fought for. There has to be funding, and so on. And otherwise, *when there is no information, there is no problem. And when there is no problem, you don't need resources for it.*

When Belrad radiologists conduct WBC tests in schools, they typically give the list of doses to the school officials so that they can "take measures." For example, on the trip described in the next chapter, the head of a high school (*zauch starshih klassov*) made copies of the list of doses in preparation for a meeting with local administration. Belrad driver commented privately that the team frequently had problems with local administrations:

> Especially with those who might be responsible in any direct way. They try to impede us in any way. Because 'everybody [in their care] is healthy.' One local doctor told us that we 'get in the way.' He said he had his own WBC but we never saw it.

There are local interests who would prefer the problem to remain invisible as it might create work, put strains on already limited resources, and make administrators personally responsible.

Aglaya acknowledges that less and less is said in the media regarding radiation, and brings up the importance of local action: "If we are not going to raise that question [the question of radiation] locally, it will soon die out completely." The head of Belrad Laboratory similarly emphasizes the importance of individuals' initiative and persistence in dealing with local administrations and resolving issues, but he also observes that negative examples outnumber positive ones (see cases 7-9): "I would not say that everything gets fixed like this, there are more negative cases."

**Examples of Local Action and Dealing with the Bureaucracy of Local Administrations (trascribed in full from interviews with Belrad radiologists)**

**Case 7. A Rare Positive Example**

In Luninetsk District, there is village N; the school there has 450 children, not a large school. The principal of the school is very interested in solving these kinds of problems. One of the school teachers is also a radiologist at the radiation control center. They are both very concerned for the children and work to solve the problem. They achieved great success. They got the local authorities interested in their information [*raispolkom, sel'sovet*]. They started conducting workshops on the basis of their center—first, a district workshop, than a regional one—addressing the questions regarding how to solve this problem. Then they asked the regional authorities to help with clean mixed fodder for the cattle and with some other issues, the issues actually got resolved. But this is a rare case. When the principal called me, I told him to send me copies of all the documents because it is such a rare case. So that I can show to other people that, if there is enough motivation and enough confidence, this can be achieved. I want to show it as an example because many say: "So we write a letter to the authorities and then what? Nothing is going to come out of it." Of course, this kind of pessimism is justified to a large degree, but there are positive examples.

**Case 8. The School Stadium**

In one of the villages, they asked us to measure background [radiation] on their school stadium. We did, and it turned out to be higher than acceptable limits. The school reported to the regional authorities [*raiispolkom*]. The regional authorities sent the sanitary team [*komanda sanstancii*] to take measures. So here are the measures they took: the sanitary team made the tests and gave a prescription: prohibit sport lessons [*uroki fizicheskoy kul'tury*] on the local school stadium. Now they all had to be inside. The situation is quite laughable: the sport lessons are inside, but during the breaks – everybody runs outside and hangs out on the stadium. And after school, that's where everybody hangs out, too. But "the measures have been taken."

It's a question of expenses. The battle went for a year and a half. We, from our side, also asked and made demands. Eventually, it really has been done: the trucks came, took off 50 centimeters of the top layer of the soil, brought clean soil, planted grass, and that was it. Of course, it cost money, but these are gigantic results, the stadium is practically clean now.

**Case 9. Culturing Pastures**

In Gomel Region, one of the local radiation protection centers has a device for

> measuring radiation in food. And they suddenly detected "dirty" milk. The head of the district administration asked us to come with the 'chair' [WBC]. The local children had accumulations higher than 100, which is fairly atypical for that place. It turned out that the local collective farm was given money –by either State Committee on Chernobyl or regional authorities, I don't know—to culture pastures for the local cattle. The local collective farm got the money and spent the money, and the locals did not get a peatbog for cattle pasture, but rather they got the dirtiest place in the neighborhood. [The administration] probably knew it was dirty... With some joint efforts of the village authorities [*selsovet*], the local doctor, the head of the hospital, the money was found, the residents got their pasture, and milk became clean again. We came with the chair again, and the accumulations got better.

To summarize the argument thus far, the need for infrastructural solutions points to the role of local administrations, and consequently their possible interest in not maintaining the visibility of the problem if the funding is scarce. In addition, infrastructural solutions are motivated by complex interests, often not related exclusively to radiation protection. Similarly, once enacted, these infrastructural solutions acquire their meaning "in the context of other things happening" (Wallman 1998), not just their effectiveness in terms of radiation protection. For example, schools get their food supply from state enterprises that have both entry and exit control, and consequently, free lunches at school contain fewer radionuclides than if the children were eating at home, consuming produce from private plots.[186] The head of Belrad Laboratory points out that, "as soon as children stop getting free lunches as school, their WBC measurements go up." At the same time, in rural areas, there is typically one school for several

[186] Aglaya, for example, justifies her belief that free lunches should continue at school by stating their general value for children's health and not specifically Chernobyl-related reasons: "After all, children are not going to have the same kind of food at home. They are not going to have meat every day. Only in winter, when people start butchering pigs, but there will be meat for a month, not longer, and then it is only fresh for a day or two, and then it's salted, it's not the same. Free lunches in schools matter. Children are going to have an orange there, a banana; they are parents won't buy that for them, they don't have money. So I think it is important to keep free lunches."

neighboring villages.  Only children from the villages officially classified as contaminated get free lunches,  The distinction creates a social problem where some students get lunches and others do not; the teachers usually report trying to feed all the children (since there are often children who are sick or absent).  In Gomel Region, children of refugees from other Soviet republics, who do not have residency papers (*propiska)*, do not receive lunches either.  To complicate it further, from the teachers' perspective, without school-provided lunches, students are more likely to skip the last class, they are said to have "less of a tie to school," to quote a teacher from Gomel Region.  Radiological issues are not only not the sole concern, but they also blend with other issues.

Various perspectives of the laypeople presently living on the affected territories can, in turn, be contrasted with perspectives of other "affected populations" (i.e., resettlers from the most contaminated areas, Chernobyl clean-up workers.  One could also look more broadly and include larger groups of the population who were exposed to the "iodine blow" in the first periods after the accident).

## Visibility from Other Perspectives

The previous section presented the problem of radioactive contamination from the perspective of people living on the affected territories.  Dealing with this problem constantly is work.  People who live with radiation and ignore it in their daily lives are not "fatalistic" (World Bank 2002).  Rather, they are faced with a job that exceeds their resources and capacities.  The present section continues the analysis of perspectives of the affected populations, depending on their temporal and spatial positions with respect to "radiation danger." The analysis below is based on five cases, which include persons who continue living on the "contaminated" territories, and those who have moved away or never lived there, but were exposed to radiation in the initial period after the accident (when most of the country was covered with short-lived radionuclides).

Personal stories 1-5 (below) reflect interpretations of the presence and effects of the hazard (where and when is the hazard, and where and when are the effects?). While it is difficult to mark the boundaries of "Chernobyl" in either time or space, the spatial boundaries are relatively fixed by the official classification of the territories. The temporal dimensions, on the other hand, are defined less clearly. The stories offered below illustrate that there are no grounds for assuming that lay perspectives are based on the temporal framework of the "risk" concept, with its straightforward temporal relationship danger-effects and its limiting effects to the future. Following the summary of the cases, the section also offers a more detailed analysis of one of these cases: it reflects simultaneous concern about radiation health effects and dismissive attitude towards radiation protection (which might appear paradoxical if interpreted through the lenses of "risk"). The case also illustrates that various perspectives on when the effects occur might carry explicit ethical agendas: for example, future effects might indicate the need for control and prevention, whereas emphasizing past effects might point to issues of justice and care for the sick and disabled.

The individuals whose stories are described in below see themselves as "affected by Chernobyl." Chernobyl is also the area of their professional activities; unlike some other "affected" persons, they are not completely indifferent to the problem. As argued above, their perspectives appear to reflect, to some extent, individual trajectories with respect to "radiation danger," as well as whether or not they have experienced potentially Chernobyl-related health-effects, either themselves or in their families. The first two narratives, those of Aglaya and Tonya, emphasize the time of the immediate aftermath: it is the time of heightened danger and the time when they have personally experienced Chernobyl consequences. Yet, for both Aglaya and Tonya, the danger continues. Indeed, Tonya specifically makes a point that she cares now because she has already experienced a loss. In other words, having experienced the effects is what makes her concerned about the present radiation protection measures. Unlike Aglaya, Tonya lives in Minsk, far away from the "contaminated" territories, and her story has “touches” of “hypervisibility” (hyperbole) in how the danger is represented: the emphasis on the size of the apples, cats with two tails, and the great number of cancer patients. In contrast to both Aglaya and Tonya, Victor's story shows only moderate concern with either past or present danger. He “faced his radiation” years after the accident, when it was discovered that he had extremely high internal accumulation dose. Though he continues living in the area officially defined as contaminated, he considers his village to be in “a good spot.” Aleksey and Galina, who moved away from the contaminated territories years ago, locate the danger completely in the past: “people have been affected.” In Aleksey's story, there is no real "danger" at all; his unspecific state of "has been affected" is linked to the sheer fact of having resided in the contaminated area.

**Narrative Descriptions of Personal Chernobyl Experiences**

**Personal Story 1. Have already experienced the effects, but the danger continues**

Several days after the accident, Aglaya and her fellow villagers were told that they should be ready for resettling. “People were planting potatoes then, they got back from the field black with [radioactive] peatbog.” At the end, the village was not relocated, but, the summer after the accident, all the local children were sent to Moldova. Aglaya's husband, a teacher, went with the children, including their six-year old son. The site of their departure was “horrible,” and “the picture of the village after everybody has left was horrible.” After the accident, there was not much information, but there were rumors. Some people took their families and left (mostly administrators and doctors); some people left later in the early 1990s. Aglaya's village was in the zone of voluntary resettlement. Many returned later: “either their jobs did not work out, or maybe their home was calling them back.” Aglaya pleaded with her husband to leave, but he did not want to; the concern was that both of them would not find jobs, or they would not find good housing, or people would not like them in a new place. Aglaya tried to have more children, but had two miscarriages: “At the time, many women had similar problems. ... And then it calmed down. Maybe because the iodine hit [*iodny udar*: radioactive iodine decomposed soon after the accident] passed by, or maybe the bodies got adjusted.”

Aglaya was one of the first local radiologists trained by Belrad institute. When Aglaya started working as a radiologist at the Local Center for Radiation Protection, some of the tests she sent to Belrad were returned for re-testing: the numbers were too high. Aglaya tells matter-of-factly that radioactivity of the ashes from her own furnace saturated the device with capacity 37,000 Bq. Aglaya calculated it to be 200,000 Bq/kg (by repeatedly dividing the amount of ashes in half until the radioactivity would be less than the saturation limit). When Belrad experts did not believe her, Aglaya brought the ashes with her to Minsk to demonstrate them. She was concerned that other people were using similarly radioactive ashes as fertilizer for their plots. A relative, a TV journalist, had Aglaya appear in a program on radiation. After that, people started coming to her village, including later “the foreigners,” members of international projects. Aglaya's son has been sent to work (*raspredelenie*) in village Y in Mogilev Region, which is also on the affected territories. She insists that radiation "should not be forgotten about" and notes that it is not a good sign that “they still cannot find a doctor to work here. They even built two houses, but nobody wants to come here.”

**Personal Story 2. Have experienced the effects, but the danger continues and is localized on the contaminated territories. Hypervisibility of danger there**

Tonya, head of a Chernobyl public foundation, was in her early 30s and lived in Minsk when the accident happened; her daughter was two and a half years old. Months later, Tonya got pregnant: “nobody told me anything. I really think doctors should have been telling women to wait with having children.” Her son was born in September of 1987, and when he was two and a half years he was diagnosed with leucosis. The daughter also had health problems. Tonya was writing letters to everybody, “even to Seattle,” trying to save her son. She still thinks what she could have done that would have saved him. Doctors told Tonya that nobody had proved it was from radiation. But she points out that, at the beginning, the doctors were also saying that thyroid pathologies were “isolated cases” and--“look how it all came out.”[187] According to Tonya, “Parents of those children do not have a doubt, even if they are not well educated. Mothers become as knowledgable as doctors. But that only happens when the misfortune strikes.” Protecting her family from radiation is still important to Tonya: she never makes soup with bones (strontium is accumulated in bones); never buys Stolin cucumbers; nobody in her family is allowed to gather or buy mushrooms; and she does not trust the official story on TV, but reads oppositional papers “to not be fooled like an idiot.” “If I have an option, and life, of course, makes its own corrections, I try to be cautious. After all, I have a daughter and my daughter has to have children.” She comments, “As the saying goes,

[187] The rise in children thyroid cancers was noticed much earlier than any increase could be expected; the connection to radiation exposures was denied. The international organizations recognized the link between radiation exposures and thyroid cancer in 1995, after several years of delay.

'the man is not going to cross himself until it thunders.' The radiation danger exists only for those who faced the fact of illness of their child, and maybe also people with enough education behave themselves differently." According to Tonya, "People should be informed. Some would say that it is rubbish, others would behave differently. But nobody should go through what I have gone through. And what about those cats? Cats with two tails? Other deformities? Where does that come from? There have been some mutations." Tonya provides anecdotal evidence of the Chernobyl effects - based on experiences of her friends who are doctors and personal experience of interacting with cancer patients; she is convinced that the number of cancer patients has increased since after the accident.[188]

**Personal Story 3: No clear danger, but some experience of it in the past**

When the accident happened, Victor, now a local coordinator for an international Chernobyl project, was a teenager living in Stolin District. Back then the accident "did not affect his life much," though his village was in the zone of voluntary resettlment. He went to college in Minsk, and after graduation returned to Stolin District and stayed in village M. He worked at the local collective farm (kolhoz), but, like many in village M, lived off 'the cranberry trade.' Wild cranberries were gathered at nearby wetlands, known to accumulate radiation, and sold in Moscow. The problem, however, appeared to be not the business, but conditions in the house he lived in. They were so bad that Victor developed nephritis. While in the hospital, he was tested for internal radiation on WBC [whole body counter].. The results were so high that "they sent people to the village and tested everything there; radiation in mushrooms was 400 times higher than the norm." When asked why he ate those mushrooms, Victor says: "The people whose house it was would cook something and put it on the table, and everybody sat down and ate. Nobody was looking [at what to eat]." The doctors told Victor that he was young, he had to get away from there, and so he decided to leave the village. He still lives in the same district, and not too far from village M. For Victor, Stolin District is just "where I live." When asked about radiation in the place he lives now, he reacts rather dismissively: "it's in a good spot."

**Personal Story 4. No clear signs of danger either in the past or in the present, but the effects have already happened**

Aleksey, a manager for an international Chernobyl project, was a young boy when the accident happened; his family lived in the moderately contaminated areas, but it did not affect him much; in his words, his life was "parallel to it all." Nobody had any fear about radiation. Nobody, including his parents or teachers, told him that anything was dangerous. The only thing possibly related to Chernobyl were annual health examinations at school, but nobody paid much attention to them either. "When it was most dangerous, there was no information about it at all. And then people got used to it, started to forget. People only remember about radiation when they start having problems with health. Absolutely nothing ever reminded me about Chernobyl." According to Aleksey, the only thing that reminds him of Chernobyl now is his job; he never thought that trips to the contaminated areas could affect his health. Nobody who hired him ever asked if he was afraid. This was never a question. The only thing about Chernobyl that Aleksey relates to (and talks about with more interest) is the question of Chernobyl compensations and inconsistencies within the Chernobyl laws. Aleksey is upset

[188] At the same time, Tonya is also aware of other, disagreeing perspectives: "A friend of mine says, 'Who cares about radiation when there are so many children born with syphilis.'" She resolves the disagreement by referring to underlying political causes: "In either case, there is too much covering up, and people are afraid and don't say things as they are."

[189] See chapter 7 for the discussion of the logic of this reply.

that his current Minsk residency disqualifies him from particular benefits: "What difference does it make if I live there, or I live in Minsk? *I have already been affected, haven't I*? And if I live in Minsk Region, it does not make it easier for me." He does not know if Chernobyl has had any effects on his health.

**Personal Story 5. The danger and effects are in the past**

Galina, head of a Chernobyl-related non-governmental organization, and her husband lived in the town of Narovlya. Her husband was in the military and took part in the accident clean-up. He became sick and was hospitalized several months after the accident. He left the hospital "a disabled person" and later "received Article 18," officially tying his disability to the accident. Galina herself has the status of "liquidator" (clean-up worker; defined by Article 19); she was helping with evacuation of children to summer camps after the accident. When asked if she was afraid of radiation, she replies with stories of her experience arranging these evacuations in May of 1986, and cannot help crying, "The town without children is a scary place."[189] Galina decided not to let her own two daughters to be sent to these summer camps with the rest of the town children, but instead arranged for them to stay with family in Riga. In December of 1986, after her husband was decommissioned, they joint their daughters in Riga and returned to Belarus only in 1993 (they stayed in Minsk instead of coming back to Narovlya). Galina herself has health problems. Though she only stayed in Narovlya for several days after the accident, one of the daughters has thyroid problems. Galina's mother died from cancer; and the house was impossible to sell because "nobody wanted to buy a house with radiation." Galina is very upset with the lack of attention to the health care of 'the disabled of Chernobyl" and clean-up workers, but considers that now, eighteen years after the accident, the radiation danger is negligible.

Galina's perspective regarding the effects being mainly in the past is related to her interpretation of expert radiation protection advice. According to Galina, focusing on present-day radiation protection (i.e., asking people to "boil meat") is "utopist": the main harm has been caused already. Focusing on radiation safety now is a misrepresentation of the problem ("These researchers focus not on what is, but on what they want to talk about."). What the society should do is "honor and take care of its disabled." Galina is very upset with the lack of attention to the health care of the clean-up workers and "the disabled of the Chernobyl NPP," and the fact that they are losing their compensations and benefits. Galina's perspective is addressed directly to scientists, including social scientists, and it highlights the ethical aspects of focusing on future versus past effects:

> We are worried that people boil their meat for three hours, but that's nonsense. Don't take it personally, but nobody has ever done it and nobody will do it. But what can be done -nobody wants to do. ... Everybody knows that society is only then respectful when it can take care of its own old people and disabled. ... It seems to me no other country has as many disabled as we do. Tell me, are you worried about the disabled that we have already? ... Today, eighteen years after the accident, I don't think there will be more disabled people because meat won't be boiled for three hours.
>
> I think people die *indirectly* from Chernobyl: when they see the hopelessness of the situation, they start drinking, smoking, they forget about their health. Nobody is going to labor with meat here, and it is important that right moral priorities are set as priorities. And maybe then, they'd even boil meat. ... I am not against your research, I am surprised when people are fighting for what still can be or what can potentially happen and not what has already happened.

Overall, Galina's perspective relies on holding the connections between Chernobyl radiation and people's health effects unproblematic; they correspond to the 'Chernobyl tie' of particular diseases. In some instances, however, she is more skeptical. It is particularly noticeable when she considers the health status of Chernobyl clean-up workers: "I cannot tell you, I'm not a doctor, but then a doctor would not be able to tell you either, what and how is collected, because there is a chance that it's just not [collected]."

***

According to one member of an international Chernobyl project, "People have gotten used to radiation and do not take it as an acute problem. The problem is raised more often by us [members of the international project], not the residents." This chapter has both suggested that the picture might be more complex than that and also has attempted to account for the greater indifference to radiation protection on the part of some population groups. This chapter has argued that the affected populations are not homogeneous; they neither completely disregard the problem, nor are they, for the most part, over-concerned or too anxious about it.

The chapter describes the complexity of the situation: the tight intertwining of socio-economic, cultural, geographic, radiological, and other factors. Due to these dramatic combinations of factors of various origins, the least socially protected groups appear to be the most vulnerable to accumulating particularly high doses of internal radiation. Forests and private plots (often contaminated through “radiological chains” linking them to forests) become the major sources of internal accumulations by individuals.

Individual risk behavior appears to reflect a host of sociological factors, but I have also argued that these factors should be interpreted with care: they are particularly noticeable in extreme cases of the highest and lowest individual dose accumulations. Changing or “fluctuating” behaviors of the large group “in-between” these extremes are better described through contextual factors: radiation danger is a pervasive problem; dealing with it requires a constant effort; and individual behavior fluctuates depending on public visibility of the problem. The fluctuating behaviors and the fact that most visibility reminders are temporary suggest that some vital elements of both radiation protection and people's education have to be built into the existing infrastructures. At the same time, the problems will remain contingent on and subject to local power struggles. Finally, different temporalities of various individual perspectives, depending on how and when individuals perceive themselves to be affected and their varying life circumstances, reveal the underlying ethical concerns and, again, the complexity that far exceeds what is captured by the concepts of 'risk,' or anxiety, denial, and fatalism.

# Chapter 7.

# In Dialogue with the Affected Populations: Articulating the Signs of Danger

The previous chapter has described laypeople's multiple perspectives on the scope and character of radiation danger, depending on socio-demographic factors, particular local—socio-economic, infrastructural, radiological—circumstances, and individuals' temporal and spatial trajectories with respect to 'radiation danger.'[190] This chapter continues the discussion of laypeople's perspectives by examining the dialogical character of these perspectives, as well as some of the particular interactive contexts in which these perspectives are shaped. The chapter pursues further examination of why people living on the affected territories are not more concerned about radiation danger.

To answer this question, I emphasize that radiation is not immediately perceptible, but its presence and scope are only given through social interactions and in the context of social interactions. My overall argument is that how people 'see' radiation danger is not pre-given; it is instead a matter of interpretation, which, in turn, depends on the kinds of articulation opportunities that are available. This chapter will demonstrate that very limited opportunities for discussion and articulation of invisible danger result in limited 'seeing.'

---

[190] As in the previous chapter, the quotation marks are used to indicate the highly constructed character of the hazard and its effects (which does not take away from its seriousness or consequences). Properly speaking, "radiation danger" refers to representations of this hazard through formal representations (see chapter 5) or narrative descriptions.

The chapter considers various contexts where people's activities are related to Chernobyl and where, through interactions associated with these activities, laypeople could articulate (identify, define, and further clarify) the local scope and significance of radioactive contamination, radiation effects, and what can be done about it. These 'articulation spaces' could be critical to making local Chernobyl consequences more visible. These spaces are not limited to contexts of interaction with science or scientists; administrative contexts constitute the primary 'articulation spaces' for laypeople's assessment of Chernobyl radiation danger in their environment, which leads to particular, sometimes paradoxical, ways of interpreting it. The production of invisibility on this level refers to what articulation spaces are available and what interpretational frameworks are excluded by particular articulation spaces.

## Experiencing Invisible Radiation

### Local Experience

Descriptions of laypeople's attitudes towards radiation risks contain an interesting paradox. Nuclear (and chemical) hazards score high as dreaded potential hazards, but, living on the contaminated territories, people can be aware of the contamination and apparently indifferent to it. The psychometric paradigm of risk analysis places nuclear risks as scoring high in the “dread risk” factor (Slovic 1987), [191] which is defined as “perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of risks and benefits” (1987, 283). According to Slovic, “The

---

[191] ‘Nuclear risks’ are taken either ‘together’ or as partitioned into such risks as nuclear accidents, etc. However, Paul Slovic, the author of the study, does not define what is “risk” for his subjects (1987).

higher the hazard's score on this [dread risk] factor..., the higher its perceived risk, the more people want to see its current risks reduced, and the more they want to see strict regulation employed to achieve the desired reduction in risk"(1987, 283). The model seems to predict that people would fear nuclear risks, perceive them as threatening, and demand regulation. Yet Kenneth Gould argues that the intuitive assumption that "the closer people are to the source or the consequences of pollution, the more likely it is that they will organize to reduce their exposure to it" (1993, 158) is not always true. Gould argues that increased social visibility of the contamination, its sources and effects increases awareness, but not necessarily people's concern about the hazard and their political mobilization.

Thus, paradoxically people are not more, but less concerned when exposures are no longer 'potential' and they are living with invisible hazards. As noted in the last chapter, Svetlana Alexievich (1999) observes that 'Chernobyl' is not experienced in the same way everywhere, and that what is remarkable about local residents is the indifference with which they talk about it. A member of one of the international Chernobyl projects, who, himself, grew up in one of the affected areas of Mogilev Region, asked me why foreigners were interested in solving Chernobyl problems: "It is mostly foreigners who are passionate about Chernobyl problems and not the local people." The paradoxical decrease in concern that might happen when people are more familiar with the actual circumstances of living with radiation is also apparent in changing degrees of personal precautions. Another local resident and member of the same Chernobyl project argues, "[Foreigners] come here and see that everything is normal. Radiation is scary only the first time you go to the [Chernobyl] regions and see abandoned houses there." The first few times foreigners visit, according to a member of a local Chernobyl-related NGO, they show more concern and take more precautions. Some international humanitarian teams (e.g., to help renovate an orphanage in Vetka, a particularly contaminated town), for example, bring their own food and water supply (and a chef), though they might also eat in restaurants. The same local resident and member of an international Chernobyl project comments that foreigners who come to the contaminated areas "take many measures, and those who live there permanently..."—he waves his hand indicating nothing, no precautions.

In her essay "Experience," Joan W. Scott argues against uncritically privileging 'experience' (in critical gender studies). For Scott, accepting experience as a source of knowledge relies on the unquestioned tie between visibility and knowledge, i.e., the view that: "Knowledge is gained through vision; vision is a direct, unmediated apprehension of a world of transparent objects. ...Seeing is the origin of knowing." Scott's concern is that this approach "takes meaning as transparent"—instead of examining how meaning is reproduced through "given ideological systems," within which social categories, such as gender and race, are naturalized. We can assume, then, that 'telling' experience relies on visibility of some relevant phenomenon and on availability of 'naturalized' categories that give meaning to it.

This foundation of experience—visibility of the phenomenon and availability of 'naturalized' categories that would give experience its meaning—appears to be more problematic in the context of imperceptible hazards. Martha Fowlkes and Patricia Miller (1987), in their study on "Chemicals and Community at Love Canal," contrast imperceptible hazards with "conventional sudden impact events (either natural or man-made)," which are "accessible in commonsense terms"; interpretations of the situation emerge "spontaneously" (1987, 55).[192] Destructive consequences in these cases "are apparent and leave no doubt as to the immediate relationship between cause and effect," even if "individuals may exhibit a wide range of responses to them" (1987, 56). In case of living with invisible hazards, the situation is different. Fowlkes and Miller describe the experience of Love Canal residents: "each family found itself in an unusual and difficult position of having to evolve its own definition of the significance of the chemicals. Facing either the possibility or desirability of relocation, families were *required to articulate coherent perspectives* about the actual or potential implications of the chemicals in their well-being" (1987, 55-56, emphasis added).

A similar observation was made by Ulrich Beck for modern invisible risks in general (also discussed in chapter 1); he argues that these hazards fall outside "the orbit of cultural experience" (1995, 184) and that laypeople are "culturally blind" to these invisible risks (1992, 27). In Alexievich's book on post-Chernobyl experiences (1999), multiple interviewees mention not being able to find words to describe what they saw and felt, and Alexievich comments:

> Something occurred for which we do not yet have a conceptualisation, or analogies, or experience, something to which our vision and hearing, even our vocabulary, is not adapted. Our entire inner instrument is tuned to see, hear or touch. But none of that is possible. In order to comprehend this, humanity must go outside its own limits. A new history of feeling has begun (1997, 20).

---

[192] Gunter and Kroll-Smith (2007) make an argument that the consensus is more easily achieved in this case, which can also be said to relate to the 'commonsense' nature of interpretations: "Reason suggests that a consensus [within affected communities] is easier to achieve, when the evidence of destruction is visible, unavoidable, and uncontestable. A tornado touches down and ravages a street, leaving little doubt about damage" (2007, 127).

Imperceptibility of the hazard thus implies unavailability of spontaneous, commonsense interpretations; and articulating these interpretations might require an effort. A woman in Minsk, reacting to my occupation as a social scientist, remarked that, "[academic] theory is just like radiation"—in the sense that it is not immediately observable.[193] I suggest that the comparison might be reversed: radiation is like theory as well—it too has to be established and articulated.

Kenneth Gould, in his study of laypeople's environmental mobilization and its relationship to invisibility of hazards (on the example of environmental problems in the Great Lakes area), argues that even when hazards are made visible, it does not necessarily lead to greater mobilization among local residents (mobilization and taking precautions are not necessarily the same type of a response to hazards, but they both point to an interpretation of hazards as dangerous). Gould concludes that while making hazards visible—in order "to counter industrial and governmental unconsciousness-making efforts" (1993, 176)—is a necessary condition for political mobilization of the affected populations, it is not a sufficient condition.[194]

We might conclude that imperceptible hazards—even when 'made visible' through activist efforts—present a significant articulation challenge; closer attention should be paid to how these hazards are interpreted and in what contexts. (I do not suggest that the level of precaution would match discourse about the hazards (see chapter 6), but that without an adequate level of articulation of the threat of the hazard, the degree of attention to precaution might also be inadequate.)

[193] Incidentally, the woman did not know the topic of my research.
[194] According to Gould, social visibility of the hazard in itself "is not sufficient to explain the emergence or non-emergence of local mobilization," and political mobilization is better explained through other factors, such as socio-economic motivations of the affected populations (1993, 176).

The rest of this section considers what the process of articulation might involve, including the nature of laypeople's reliance on scientific and administrative discourse in their interpretations. I emphasize the prevalence of administrative interpretations, and highlight the *dialogical* character of laypeople's references to expert and official perspectives (the discussion of dialogical perspectives was offered in chapter 6). The rest of the chapter considers examples of particular 'articulation spaces' and concludes with comments about the relationship between these articulation opportunities and the production of invisibility.

**Articulation**

The previous section has argued that invisibility of particular hazards implies lack of spontaneous, commonsense interpretations available for laypeople. Developing these interpretations depends on being able to identify increased levels of radiation (identification, in this case, might rely on mediation with particular tools and technoscientific representations) and on identifying radiological and health consequences of exposures in one's environment and oneself. To further describe this mediation and account for the role of bodily reactions, I introduce Latour's concept of 'articulation' (2004). Applying this concept helps further elaborate why developing coherent interpretations of imperceptible hazards poses a challenge for laypeople living with them.

Latour's concept of 'articulation' refers to one's body being able to tell the difference when affected in different ways. He uses an example of a person training to become a 'nose' for the perfume industry: learning to tell the difference between smells is achieved in the course of the training session, with a kit of contrasting odors and a teacher. At the beginning, the student is inarticulate: “different odors elicit the same behavior”; “an inarticulate subject... acts or says the same thing,” regardless of how s/he is being affected or what the other says or does (209, 210). In the course of the session, however, “the body [is] learning to be affected” (2004, 209) and tell the difference between odors.

Latour’s concept of articulation emphasizes mediation: the role of the kit of pure, contrasting odors (“The specialist has bottled up contrasts in a systematic way” (2004, 207)), and the role of the teacher who has benefited from ‘the collective body’ of knowledge in chemistry and setups of chemical laboratories. Articulation, as a concept, thus accounts for the accumulated expertise and developed tools and techniques—“the artificial and material”—that are essential to “learning to be affected” (2004, 209, 210). Latour specifically does not make a distinction between laypersons and experts. Just as experts’ telling the difference depends on their mediation set-ups, “[t]he phenomenology of the lived-in body is every bit as dependent on material artifacts” (2004, 225). Furthermore, ‘being affected’ need not be limited to developing and recognizing pathological bodily reactions (diseases); the idea of articulation refers to broader contexts of ‘telling the difference’ with one’s body or through one’s body. I emphasize here that Latour’s “artificial and material” has to include tools and techniques developed over the course of previous collective efforts to ‘tell the difference’ between odors and that categories used to describe odors are as essential to the process as the actual physical artifacts.

Linda Soneryd (2007) applied Latour’s concept to the context of controversies about exposure to invisible electromagnetic fields generated by mobile phones. She notes that the advantage of this approach is that it calls into question the search for accurate representation of reality, “an accurate, stable referent” (2007, 288).[195] All the positions—including those of experts and laypeople—become more dynamic, changing. Thus, the concept potentially accounts for embodied learning,[196] mediation set-up, and dialogical and interactive contexts.

The problem, however, is that the concept is based on an explicitly professional setting: Latour’s example includes a purposeful, contained set-up (the training session, with its kit and teacher), established tools of mediation, and a well-developed area of expertise—all used to teach an individual to tell the difference and become articulate. The case of people living with invisible hazards complicates this in several ways. The context of laypeople’s interactions relative to the invisible hazard is not contained by narrow laboratory settings. People also might have little motivation for articulating increased levels of radiation. As has been shown in chapter 6, articulation (knowing the radiation levels) might mean more work for individuals; having to react differently in this case is continuous and demanding work. Furthermore (and this is the central issue in this chapter), we have to ask: What are the mediation set-ups used by laypeople to ‘tell’ increased levels of radiation and its affects? Or, in other words, what are the spaces where people learn to ‘tell the difference’? What are the tools and expertise used (i.e., what are the equivalents of the kit and the teacher’s expertise in the training situation)? What are the categories used to describe the situation? As suggested in the previous chapters, interpretations are not only shaped in particular local, interactive contexts, but

[195] According to Latour, “the more artificiality, the more sensorium, the more bodies, the more affections, the more realities will be registered. ... The more you learn, the more differences exist” (2004, 213).
[196] Soneryd writes that articulation “denotes affects, without reducing it to the antonym of dissociated knowing” (2007, 288).

are also dialogical. Dialogues with what other perspectives shape laypeople’s interpretations?

### Lay Dependence on Scientific and Administrative Discourses

Ulrich Beck suggests, as discussed above, that since laypeople are “culturally blind” to invisible hazards and their senses are “arrested”; they depend on scientific or administrative knowledge (1992, 27). I interpret Beck’s argument to suggest a lack of ‘commonsense’ ways to identify, interpret, and imagine these hazards—at least in the initial stages; the issue is what articulations, if any, become ‘commonsense’ over the course of time. The dominant approach in research on laypeople's perceptions of radiation danger seems to prioritize laypeople's interpretations of scientific perspectives: studies examine either how well laypeople understand science (risk communication approach) or, more critically, how contextual factors influence laypeople's attitudes towards science, provided its institutional context. The later type of research has been done also in the context of European fallouts of Chernobyl radiation. Brian Wynne (1992) argues, based on the example of Cumbrian farmers in England, that laypeople relate to expert assessments of their risks in the context of complex power relations, and might prefer to remain 'ignorant' of expert interpretations in cases when their identity is threatened (Wynne 1992). Similarly, Robert Paine (1992) considers Saami farmers responses in Norway to Chernobyl radiation fallout, and argues that the farmers perceived their own knowledge and cultural identities as being delegitimized by the expert advice, and that experts were not considering the socio-cultural costs of their advice. [197]

As a side comment, these observations might apply not only to scientific advice but to interactions with 'outsiders' in general. Indeed, simply conducting observations or interviews in some of the affected (mostly rural) areas triggers a similar dynamic, where local farmers might perceive their identities as threatened, either because they are living in a 'contaminated' area or because they are not 'experts'. I found the humor particularly telling; it was used extensively to distance from experts as “others,” to make fun of expert radiation protection advice, or even to mock the way experts would see the local context as “backwards” or dangerous. For example, a forester from a contaminated area described his experience with experts: “One woman came to my forest to measure radiation. Her eyes are all round, she's almost running from there and she says, 'Yes, it's all within the norm here.'” The same local, in reply to a question regarding whether he was worried about radiation in his village replied, with irony, “No, you can move here” and laughed. A local woman from the same village said, mocking scientific advice, “I don't feel any radiation - we cleanse [with wine] on holidays.” Or, in another district, a local man comments, when a person from a visiting international team lost her cell phone connection: “There is no cell phone connection here—it's Chernobyl."

Analysis in this chapter suggests that scientific discourse and interactions with scientists are not the only, or even the primary, context for shaping laypeople's perceptions of Chernobyl radiation danger. The kinds of scientific discourse that reach

[197] Both Wynne and Paine are describing the circumstances shortly after the accident, thus comparisons with longer-term contexts (e.g., two decades after the accident) should be made with caution.

local residents are fragmentary and rather inconsequential to people's daily lives (notably, the majority of people I spoke to—with the exception of few local radiologists—were unaware of the controversies surrounding estimation of Chernobyl consequences). At the same time, the locals are very conscious of the nuances of the official position; their own interpretations are shaped in interaction with this perspective.

Lay people's presentation of the official discourse is often dialogical. An example below is drawn from my conversation with several local residents in the village of Selo (the description of the trip is provided below). I was talking to two farmers when their friend, an older man with few teeth and breath smelling of alcohol, joined us. He was eager to offer his own analysis of the radiation control measures and the political struggle behind them:

> They used to lie all the time, and now they keep on lying. Radiation is still here but they make a secret of it. They were measuring it at the beginning and it was here, and then in ten years it all disappeared? But the half-life of cesium is 300 years. And what about other elements? Other kinds of cesium, plutonium? ... And why there is more radiation in Gomel and Mogilev areas? On the third day the wind was towards Belarus and then it was going towards Moscow. And Moscow is the size of the whole Belarus together, so they made -artificially-it rain so that it does not reach Smolensk. So it all landed in the Gomel and Mogilev regions here, and on Bryansk Region in Russia. Tell me, have they fixed all the consequences in Japan already? They still have not fixed all the consequences there either. [The other man brings up the fact that Chernobyl compensations, 'coffin money,' have been cancelled]. Maybe that's understandable. The state is poor. But the fact that they cover up information [disapprovingly]. The soviet government back then, our 'Daddy' [the president] now. But then again, maybe it's all good. First, the weakest died off. Then the ones with less stable health die off. Only the strong ones will be left.

The account this man gave, regardless of the accuracy of the detail, *explicitly accounted for the history of public discourse* and official action, and it *captured several different positions* with respect to this official discourse. His statements echoed the oppositional critique of the government ("radiation is still here but they make a secret of it") and, prompted by a remark from his friend, the perspective of the government itself (the government cannot pay compensations because "the state is poor"), though he elaborates this position into a kind of ironic 'social darwinism.' (Paine 1992). When asked where his information came from, the man listed names of the local and national newspapers and then laughed, "Take your team and come over to the club tonight. I'll get changed and give you the whole lecture."

***

The rest of the chapter offers discussions of several particular 'articulation spaces'; the contexts discussed here are interaction with radiologists, officials, and international project members where radiation danger is assessed and interpreted. The contexts of interaction with outside perspectives are chosen to emphasize different ways of interpreting the situation: what they make visible and what they exclude. The last section in this chapter extends conclusions from these specific settings to local assessments of Chernobyl health effects more broadly. Descriptions are offered on the basis of observations and interviews made during trips into affected districts, with radiologists from the Independent Institute of Radiation Safety "Belrad," and then with a team of the international project CORE (for a detailed description of Belrad, see chapter 5, for the description of CORE, see chapter 3; detailed descriptions of the trips are provided in Appendix *Data and Methodology*).

The examples in the following section are based on one trip with members of Belrad's Laboratory for the Spectrometry of Human Radiation. The village visited on that trip is referred to as Selo; [198] a nearby resettled village is referred as Otseleno; both villages are inside 'contaminated' spots surrounded by larger 'clean' area. During the trip, I talked to the school administration, teachers, and staff, who were both supervising children through the process of measuring their internal radiation doses and getting tested themselves. At the end of this section, I also include excerpts of interviews with local residents conducted outside of the testing context.

### Interpreting Radiation Danger in the Context of Radiological Testing

The goal of the trip, for the Belrad team, was to conduct measurements of internal radiation on children in a local school. Most of the children—born many years after the accident in this area of relatively low contamination—had not been tested before, and the Belrad team, a radiologist and a driver, brought a mobile whole body counter (see figure 7.1): a testing 'chair' connected to a computer. The WBC was set in a regular classroom; Nikita, the radiologist, calibrated the counter and then invited children (visibly excited about the procedure) to sit in the 'chair,' one after another.[199] After the testing, each child (if old enough to read) received a leaflet with their results recorded on it (figure 7.1); inside the leaflet were instructions for how to lower internal accumulations of radionuclides,[200] addressed specifically to children.

[198] Selo had about 900 residents, and the local school (including kindergarten) had 180 children, including children from adjacent villages.
[199] The school administration assisted with organization of the testing process. Testing was done by year cohorts. Groups of children were let into the classroom, while the rest of the cohort waited outside, in the hall.
[200] Recommendations suggest how to treat meat, mushrooms, and milk.

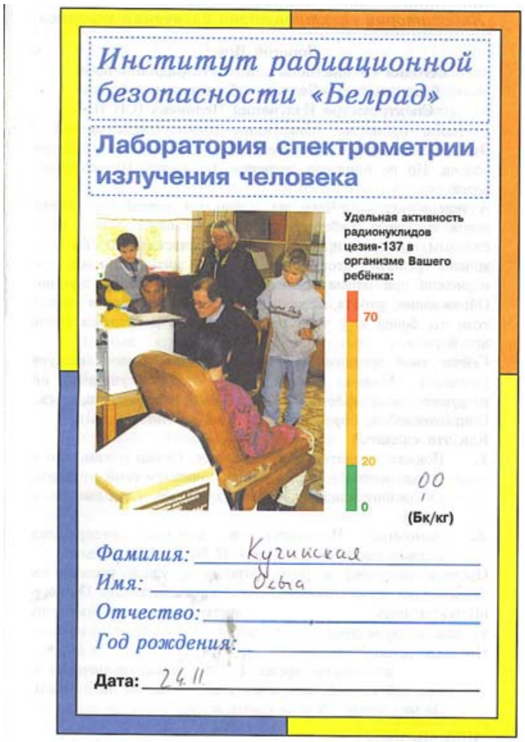


**Figure 7.1** Cover of the Whole Body Counter Testing Leaflet, Belrad Laboratory for Spectrometry of Internal Radiation of the Human
The picture shows a boy sitting in the 'chair' of the whole body counter (WBC), and a man looking at the testing results displayed on the computer. The green-yellow-red scale next to the picture provides the comparison scale for the individual number, recorded next to the scale (the scale is in Bq/kg). In this case, the number is zero; the subject did not have internal radiation above the sensitivity level of the meter.

The whole body counter (WBC) is a particularly powerful tool for making radiation visible, but the situation of testing excludes as much as it makes visible. Conversations prompted by testing, described below, negotiate connections between the highest doses and causal explanations for these doses.[201] These discussions contain partial references to other contexts (such as broader economic activities), but generally other contexts are suppressed and deleted; the meaning-making is organized by testing

[201] The discussion of these interpretations and how they were made (offered below) illustrates some of the classic issues in the studies of public understanding of science.

results and the authority of the radiologist. Connections are made visible and interpreted in the context of the radiologist's professional knowledge (radiological expertise): his advice and instructions, booklets, normative descriptions, and information provisions (including to school administrators).

**Ethnostatistics in the Making?**

In the context of WBC testing, internal radiation is highly visible; it is made the focus of everyone's activity, and provides the angle for interpreting people's past behaviors. Other contexts are subsumed; competing explanations, logic, and motivations are ignored. The measurements affect the social dynamic: everyone's numbers are openly compared and judged. Children ask each other, "Show me, what radiation have you got?" Teachers and staff wander around making comments like, "I'm going to spy around, who's got the highest radiation" or "It's just left to see who's got the highest doses."

The discussion, both in front of and inside of the WBC classroom is not just about the levels ("It's mostly children [not adults] who accumulate doses"[202]), but also about providing causal explanations based on shared background *interpreted through the lens of the measurement*. In this discussion of 'levels,' the schoolchildren and teachers appear to be shaping their view of the local scope and nature of radiation contamination, as well as their own popular statistics.[203] Explanations for how people get 'high levels' are advanced: "She's a milk-lover," or, when a boy's WBC results are much higher than other children's, a teacher comments to her co-workers that his father is a forester. The

---

[202] Comment by a primary school teacher waiting for a class of students to be tested.
[203] Brown (1992) describes 'popular epidemiology,' "the process by which laypersons gather scientific data and other information, and also direct and marshal the knowledge and resources of experts in order to understand the epidemiology of disease" (1992, 269).

school nurse gets up from the ‘chair’ after learning her ‘low number’: “I don’t eat meat and I don’t eat mushrooms.” Some of the teachers’ explanations are given directly to me as somebody who might not know the local situation: “There is a relationship between WBC measurements and what people eat... My neighbors, the whole family, live on ‘pasturage’ [reference to what can be gathered in the forest or produced on one’s own plot]. Of course, their WBC would show it.” Older children discuss the measurements enthusiastically:

> - I have the most radiation... It is because I’m the fattest.
> - No, it’s because you eat too many mushrooms.
> - I don’t eat mushrooms, I don’t like them.

Precisely because the situation of testing excludes other contexts and explanations (e.g., daily work interactions and routine economic or administrative contexts), articulations of radiation danger made in this context fit well with topics discussed in the studies of public understanding of science or risk communication. From this point of analysis, the comments made by the locals could be described to show how much (and what kinds of) earlier information on the scope of local contamination they reflect. The comments also provide ample grounds for observing, for example, whether or not schoolteachers living in a contaminated area understand the difference between external radiation exposure and internal accumulation of radioactive substances—a classic issue in public understanding of science (e.g. Miller 1994). Despite the locals’ obvious significant levels of knowledge about the situation, their comments about how a person can accumulate an internal radiation dose are often imprecise; connections—between radiation levels and family lifestyle, where they live, and what they eat—are frequently made in rather sweeping ways: “Well, you are the cleanest because you live in Selo [not in one of the smaller neighboring villages].” Or, when a woman shows a higher dose, others comment, “She lives on the street with the highest level of radiation.”

These explanations do not differentiate exact causal ties: reference to living on the most contaminated street might mean that garden soil there is more contaminated (consuming contaminated food leads to increased internal accumulation), or it might (incorrectly) refer to external radiation exposure. This typical non-differentiation between external exposure and internal accumulations is obvious when the school librarian is waiting for her test results, “Ok, let’s see where I have been wandering.” In the last statement, it appears that wandering in the areas with higher radiation might cause one to have higher *internal* radiation.[204] Similarly, the head of high school (*zauch starshih klassov*) inquires about the average levels and, looking through the list of doses, spots the guy with the highest level: “It’s strange, he was born in Grodno Region [which is considered ‘clean’].” Or, the cleaning lady asks Nikita: “Can I get tested, too? We used to live in Otseleno [resettled village]. Got resettled from there to Selo [about 5 miles away]. What can you say? Good resettlement [with irony].” “Alla has 33. They used to live closer to Otseleno. So it’s good, uh?” In some cases, flawed logic is corrected by others:

> Teacher 1: I will have high radiation, I live close to the forest.
> Teacher 2: It is not going to affect it, if you live by the forest.
> Teacher 1: *And* I drink a lot of milk and I eat meat. It is not going to be good.

Similarly, a mathematics teacher’s comments about a girl who “lives on the street with the highest contamination”: “But her parents are vendors. They don’t have a plot,

[204] WBC measure internal accumulations of radionuclides, not the doses of past exposures.

they buy everything. It's difficult to say [where the girl got radionuclides from]." Most importantly, it is not always clear how much these scientifically-significant nuances of understanding matter practically, in people's daily lives (see the section on 'objectification' below).

**The Expertise of a Radiologist (Visibility and 'Professional Vision')**

How radiation is made visible during these measurements is organized not only by the WBC equipment, but also by the radiologist's interpretation of the numbers and behaviors—the 'professional vision' of the radiologist (Goodwin 1994). In one incident, Nikita asks a small boy sitting in the chair whether he's been eating mushrooms; the boy replies that he has. Nikita hands him a colored leaflet (see figure 7.1), in which the boy's internal accumulation is written next to the scale—the boy's "number" is not off the scale but it is in the 'red zone,' which implied that he should do something; Nikita tells the boy to drink some *Vitapekt*.[205]

In another case, Nikita signals me to look at the monitor when a second-grader is being tested: the graph is drawing peaks. The boy's dose is 180 Bq/kg, which is still not too high by the state thresholds, but the number is *beyond the scale* in the booklet, and higher than the other children (Belrad scale is based on research conducted by Prof. Bandarzhevsky; see chapter 5). As the boy tells his classmates 'his number' later, one comments, "What are you, irrational? [*nerazymny*]?" Nikita again provides advice: the

[205] The Belrad team brought packs of *Vitapekt*: an apple-based food supplement (pectin) absorbing radionuclides, given to the school administration. According to Nikita, *Vitapekt* was handed to the administration so that it is given to children in school. *Vitapekt* is a powdery substance to be dissolved in a glass of water; it tastes somewhat sour, and children do not always make it or drink it if given directly. From experience, Nikita notes that the supplement does not always reach children if they are asked to bring it home.

boy should drink some Vitapekt. When the boys leave, Nikita turns to me: "Some even gather mushrooms by the resettled village. That would not be unusual. ... But to find one boy like him, that's good already." In other words, the value of Nikita's work is precisely identifying these higher levels and alerting the child and perhaps the teachers so that the child is not fed mushrooms and s/he drinks radionuclide-absorbing *Vitapekt*.

Nikita comments that mushrooms are a much more significant portion of people's diet here compared to people in the cities, where much smaller amounts of radioactive substances that one would consume with mushrooms "are going to get out of you pretty quickly." Nikita's line between what is or is not good for you is finely articulated: he does not advise the locals not to eat mushrooms altogether; he also disapproves of my general comment that, "radiation is not good for you in any case"—"Everything is not good for you. If you look at that, there is nothing we would be eating at all." Nikita himself grew up in a village, and years of working as a radiologist made him very aware of the nuances of locals' daily lives: "We just saw a big bag of dried cep mushrooms for sale. A bag is 30 kg. This is very significant money for village people. And typically, nobody even looks where it's clean land, [and] where it's contaminated land." The economic or other daily contexts deleted from people's interpretations thus partially re-emerge in Nikita's statements and in his implicit awareness.

Explanations for higher levels of internal accumulation, reinforced by Nikita, are reproduced by the locals as 'valid' explanations. As we are packing to leave later, a custodian woman comments to me about the "boy with the high number":

> A boy from the second grade has got 180 and something. Just in the second grade.... His mother works as a cook in the school. We asked her if that's from mushrooms. She said no, otherwise she'd have it [an increased level of

> accumulation], too... But where from, if not from the mushrooms? They have a load of them, and they are from that area [the particularly contaminated spot around the resettled village].... No, she does not live there now, but her parents used to live there, and she knows the forests there very well, so she has loads of mushrooms every year.

This kind of discussion of who has the highest doses and why, takes place throughout all the time Nikita is making the measurements, class by class, person by person.

The practice, however, is not welcome by everybody. While most of the teachers wanted to get tested too, one kindergarten teacher asks Nikita, "What do these measurements do for you?" She looks rather unimpressed with the explanation, but does not comment, only declines an offer to get tested herself: "I don't want to know." According to Nikita, this happens all the time: "People just think that, 'the less you know, the better you sleep.'" The principal of the school, who overhears the last comment, replies, "Yes, you sleep better, but not for long." The woman who did not want to have her internal accumulation measured came back at the end of the day, when we were preparing to leave; since everyone else was getting tested, she had decided to, too, she said.

**Objectification**

The context of radiological testing provokes recollections and negotiations of the previously received advice and information; it also, at least partially, reinforces it. In a sense, it is partially a normative practice. As is obvious from the quotes above, people do, overall, show considerable levels of knowledge about their radiological situation and the nature of the problem. For example, an older teacher with a particularly low 'number' tells Nikita that she does not eat mushrooms, does not use ashes as fertilizer for her plot, or even burn wood (she uses gas and briquettes), and thanks him for doing the tests, saying she will feel calmer now when her grandchildren visit. The advice is not accepted uncritically; the same woman calls advice in the leaflet suggesting that boiling meat in salty water reduces the level of radiation in it "BS" [*chepuha*]: "Salt is also not good for you. I am used to eating without salt."

Previous radiological advice appears to be preserved in particular ways. Neighborhood places that are more contaminated and food products that are known to accumulate radiation objectify radiation. Radiation is completely and almost perfectly contained within these places and objects. As a woman in Minsk remarked, with irony, "We have a particular kind of radiation in Belarus: it is all in mushrooms and never in potatoes." Everybody I talked to in Selo referred to Otseleno as 'contaminated,' the area in the opposite direction as 'clean.'[206] References to this spatial demarcation came up both in how people described their neighborhood to me and how they talked about their activities. For example, a typical description would be:

> Over there [towards a resettled village], it's really bad... Everybody knows that the most radiation is there. All their three houses were resettled elsewhere. And over there [a different neighboring village], it's clean.

To take radiation precautions, then, is to avoid particular places and objects. A full quote from the older mathematics teacher already mentioned above describes her activities in the following way: "I collect berries only by the sanatorium, not by Otseleno.

---

[206] 'Clean' and 'contaminated' spots are identified based on the very fact of resettlements and also based on maps of radioactive contamination of the district that used to be displayed in the radiation control center (now closed). This will be discussed below.

I have never been much of a mushroom-lover. Even less so now. I only use wood for kindling. I throw ashes away, I don't use them for my plot."[207]

In this and other statements, to follow radiological advice is, primarily, not to collect mushrooms or to collect them in the 'clean' areas; establishing which areas are clean may have been by testing produce even just once before. The head of Upper Classes comments: "We don't gather them here, we go to the other side—it's clean there. We got mushrooms tested in the sanitary center in [the nearby town]."[208] In the words of saleswomen in the local shop:

> *Saleswoman 1*: We don't collect mushrooms in Otseleno, but yes, we eat mushrooms.
> *Saleswoman 2*: Well, [the family of Y.] go to Otseleno, they gather there.
> *A woman-customer*: People got used to it, some even gather mushrooms in the resettled village.

Locals in other villages had a similarly strong idea about where 'clean' and 'contaminated' spots were around their villages; as one farmer pointed out to me: "Even businessmen who come here to buy berries know where more or less contaminated places are." In some cases, the baseline might not be 'clean,' but there is almost always general awareness of the differences between places.

Laypeople's knowledge about local scopes of contamination, particularly contaminated areas and their own levels of internal accumulation, is extremely important; so are the testing practices that this awareness is based on. However, to some extent, focusing on these types of knowledge is misleading. It is not accidental that most of the

---

[207] For the discussion of ashes and chains of radioactive contamination, see chapter 6.
[208] Even when local centers for testing are not used by locals regularly, they appear to be very aware of them: "I don't collect mushrooms... I get wild berries tested at the sanitary office in [the local town]. And you can get them tested at the market too."

descriptions of radiation safety practices people follow were offered in the contexts of various types of testing. Radiological information is not the only, and perhaps not even the primary, way of interpreting local radiological circumstances.

## Interpreting Radiation Danger in an Administrative-Economic Context

This section argues that people interpret radiation danger in the broader context, not just based on expert information directly about radiation risks. Rather, these interpretations build on the history of how the problem has been defined, and, in case of Chernobyl, it has been partly defined through a series of administrative measures. Consequently, laypeople's interpretations of radiation danger illustrate the role played by the authorities (and to a much lesser extent, scientists), and the contexts of interaction with them. As a result, the production of invisibility of Chernobyl in local contexts is traced through administrative decisions. These decisions erase administrative 'signs' of the presence of radiological contamination. Lack of alternative articulation opportunities and spaces, where lay people could develop ways to resist these discourses and practices (and perhaps focus on local 'consciousness-raising' efforts) cements this 'disappearance' of radiation.

I will illustrate this through the example of a particularly common figure of speech among the residents of Selo, references to "what used to be," as well as through other examples from residents of other areas. Before exploring these questions, it is important to note several features of the language that come out in these statements.

**Deleted Agency**

In conclusion of her study on remediation of Chernobyl consequences in Ukraine, Petryna observes that people she talked to frequently referred to an "impersonal and self-authorizing force" (2002, 215). Her examples are about the force of 'illness' that appears to control people's life; Petryna argues that this determinacy was crafted through administrative measures "at every step" (2002, 215). In their discussion of 'Chernobyl,' the locals I spoke with used passive forms of nouns and sentences with deleted agency: they are not naming who, specifically, has done the action.[209] In the examples below, the agency that is not being named explicitly is that of the authorities, as in the comments "we *got resettled* from Otseleno."

In statements like this, where administrative authorities appear to be implied but not named, the locals themselves are often the object of action, not the active agents, and 'not doing' is projected onto generalized 'people.' When talking about radiation protection measures, people commonly referred to what "everybody" or "they" typically do. Examples include a comment by the local school principal: "*They* [the locals] definitely don't do anything for themselves—maybe for their children." The school librarian echoes the same sentiment: "*People* live just the way they used to live."

One of the stronger statements—"people got used to it"—kept coming up in conversations, sometimes in rather socially reflexive ways: "People with some education still do something here but simple farmers, and especially old people, don't do anything at all."

[209] In Russian, the sentences literally skip the noun (for example, *Nas pereselili*); in English the equivalent is the passive form of the noun, though in some cases I translated the sentences using the pronoun 'they' – when it appeared more adequate to the sounding of the Russian originals.

**What Used to Be**

When asked about the scope of radiation danger, residents of Selo often talk about what 'used to be' and contrast it with what is now. Why such temporality? What does this line between past and present show? What constitutes that line? 'Used-to-be' comments appeared in reference to a number of different issues.

First, there are general statements that people used to care and used to worry (but that they do not anymore). The sentiments do not specify when, exactly, people stopped caring and why. If they do take precautions, it is only for their children:

> **People got used to it** [radiation]. **They used to be worried about it**, now I don't think so. I don't think they do anything special for it. They definitely don't do anything for themselves, maybe for their children. People are worried about their children. (*Principal of the School*)

Second, there used to be information and "it used to be talked about" (*ran'she ob etom govorili*). One clue to the temporality may be that the village used to have its own UNESCO Rehabilitation Center, which, importantly, distributed information and provided an opportunity for checking radiation in food stuffs. The following is a series of quotes describing past sources of information and opportunities for testing:

> **Nobody does anything anymore**. **There used to be a radiation control center, they used to have a device there**, a Soviet device. You could get water tested very easily, it was more tricky with mushrooms: they had to be squeezed somewhere. I got some water tested. [Repeats himself later] **Nobody does anything anymore**. **They used to talk about lime**—lime helps get rid of radiation or absorb it. (*School teacher*)

> **There used to be a UNESCO radiation control** center in the village. It was closed a year ago. They had a dosimeter there. One could have their food checked. They also disseminated information. ... There used to be more information spread out before; now people got used to it. (*Head of high school*)

> How do I know where radiation is? At the beginning, **they used to be measuring radiation everywhere. There was a map** of radioactive contamination of the [...] area. **Now they don't speak about it anymore.** (*Farmer*)
>
> **It used to be possible to check food for radiation at the Rehabilitation Center**. Who wanted to have it checked, could do it. Now you have to go to Volozhin, it's a bit of a trip, but if somebody wants to... (*Saleswoman*)
>
> **There used be a center** here, it was closed exactly a year ago, around New Year's... **They used to talk about it**. Not anymore. (*School activities organizer*)
>
> We checked mushrooms here once. The doses were all increased [in the sense that the mushrooms had higher levels of radiation]. So we did not eat them, we threw them away. Now we can't check anywhere, nobody has got dosimeters. [If you had a center here, would you bring products in?] Yes, I probably would. There is a center in Volozhin but it's hard to get there. They say there is a center in polyclinics there, but it's really hard to get to. Generally, everybody just eats everything**, nobody is looking for that anymore**. (*Retiree*)

The head of high school also mentions that there used to be a course titled 'Valeology' (science about health) that included much information on radiation protection; now the teachers incorporate information about radiation and the Chernobyl accident into other classes, especially around the anniversary dates.

> I teach chemistry, so I talk about radiation with the children. I teach it in such courses as 'ecology.' **There used to be a course titled 'Valeology,'** but we don't have it anymore, though teachers still talk about it, especially at the time of the anniversary of the accident.

Third, there used to be compensations for people living in the Chernobyl-affected areas, labeled by people as 'coffin money,' as well as efforts to provide gas infrastructure for the village ('gasification'):

> **They don't pay us anymore**—have not been paying for three years now. I got some 3-4,000 [about 2 dollars, maybe more at the time] deducted from my pension, so I called *oblsispolkom* [local administration]. They told me that that was money for radiation that they took away. (*Retiree [who generally sounded very concerned about radiation]*)

A similar sentiment is expressed in the quotes from local farmers at the beginning of this chapter: not receiving compensations is a particularly telling administrative sign.

> They wanted to install a gas line. The local farm was going to be the contractor for it. But then there came people from X. [the local area center] administration and they said that everything was clean here. Over there [a neighboring village], it's really bad... Everybody knows that the most radiation is there. All their three houses were resettled elsewhere. And over there [a different neighboring village], it's clean. [...] **Everything stopped**. Now if you want gas in your house, you have to pay for installation yourself. [...] [**They] used to pay 'coffin money'** before. **Not anymore**. It was cancelled a long time ago, back when administration from X [town] came here. (*Farmer*)

A young teacher--a man in his forties—adds another factor that 'used to be,' in this case health problems: "**People used to have a lot of thyroid problems**. Now there are fewer thyroids... Or it just seems that way?" One remuneration that still remains is free lunches:

> **And still it is considered that there is some radiation here**. There are free lunches at school for children, they are still there [i.e., lunches have not been cancelled like everything else.]. Our schoolchildren [from this village] get free food, children from other villages don't. But the teachers try to feed everybody, of course. If anybody from the locals is not at school, they give their lunches to other kids (*School teacher*)

The schoolteacher's statement that "still it is considered that there is some radiation here" appears particularly important. Gasification, monetary compensations, thyroid problems, and free lunches: each of these things – and not just health problems— are taken as indicators of the scope and level of radiological contamination of the area. In other words, the extent of the compensations, the presence of the Rehabilitation Center, and other attention from the authorities and international organizations are in themselves the indicators by which the locals judge the seriousness of their problem.

This connection was not immediately obvious to me, as I was influenced by Beck's *juxtaposition* of risks and economic concerns (see chapter 1). It was more apparent that radiation has been objectified in particular places or food products (resettled villages; forest mushrooms, berries, and game; milk and beef). When I mentioned to Nikita that most people I talked to referred to 'good spots' or spots where 'only alcoholics gather mushrooms,' he objected that it was more about whether people were still paid compensations. In other words, where people are paid is the 'contaminated' spot, where people are not paid anymore is 'clean.' The same sentiment was repeated to me in another trip by a head of the local initiatives, CORE project: "People perceive radiation together with socio-economic questions; you cannot separate one from the other." Only from that perspective, the following exchange makes sense:

> O.K.: Are people in Selo concerned about radiation at all?
> Local resident: **We are not paid anything for this radiation**. The only thing is free food for children at school.

Similarly, when I told the farmer and the forester that I wanted to talk to them about the problem of radiation in Selo, their reply was:

> What radiation? We are not paid for radiation anymore. And with that money, you could not even buy a pack of cigarettes. There is not much radiation here. There is a lot of radiation in Otseleno [resettled village].

Another 'used to be' is preserved food that used to be brought to the village "at the beginning." Used-to-be placed radiation as something in the past, and only to some extent in the present. This data is not enough to conclude whether the compensations and other socio-economic benefits are the key factor linked to the lay people's assessment of the extent of radiation danger; other factors, like the presence of a Rehabilitation Center and dissemination of information, may play an equally important role. I argue, however, that these and other similar factors – perhaps with different weights attached to them—

*constitute the visibility of the problem of radioactive contamination* for lay people, though not the visibility of radiation (danger) itself. By the visibility of radiation danger, I refer to its perceived immanence and significance, one of the indicators of which would be health problems (discussed below).

**Socio-Economic Context of International Projects**

Another example of the socio-economic context is activities of the international projects targeting sustainable development of the affected areas, such as the CORE program (see chapter 3). Intended to address 'Chernobyl' issues, the program addresses radiation as part of the overall context: for example, the context of encouraging local residents to grow ecologically clean produce for sale. During the meeting with local residents, radiation is brought up only in passing; the meetings that I observed were all focused on local initiative-building, and particularly economic activities, from growing and selling produce to micro-crediting. According to some members of CORE, people are interested in reducing radiation with respect to growing produce, but only specifically in the context of selling it (it would make it easier to sell). I describe this context from examples observed on a trip with the CORE Program team to several villages in Stolin District, Brest Region (see Appendix. Data and Methodology for details).[210] The CORE team included five project managers, including two agricultural experts and one economist, and two local CORE representatives—all young men. The discussion below is based on three meetings at three different villages.

[210] The specific radiological problem is milk: the district is second most populated in the country, and the lack of land results in the lack of cultivated pastures; cows gaze at the 'wild' pastures and produce particularly contaminated milk.

Each of the three villages had its own character and specific socio-economic circumstances; each had a different history with CORE. The first village had the highest unemployment rate of the three; the locals at the CORE meeting, mostly women, were somewhat more wary and reserved than in the other villages. In the second village, the group at the meeting also included a number of residents who were officially unemployed. Many people lived off their farming (specializing in cucumbers), only a small portion of the villagers was employed in the local collective farm. Most had their own private plots; these locals were more willing to share both what had worked for them in terms of the CORE projects and what had not, and to suggest their own initiatives. CORE's work in the third village was preceded by years of efforts by another international project, the French project ETHOS. More experienced in handling assistance of this sort, the locals knew better what to expect and what they could ask for.

During these meetings, the topic of radiation would surface momentarily (E.g., locals commented, in passing: "We have checked onion for radiation. Onions had 7-10Bq/kg. - What's the norm? - 100Bq/kg."), but it was generally submerged in the overall context of economic activities and had no more prominence than, for example, the issue of nitrates in produce. It was mentioned, however, that the local produce had improved in terms of radiation. In another village, the fact that people were afraid to come and work there—because of radiation—was mentioned briefly. Few people talked to the CORE agronomists about reducing the levels of radiation in produce they grow for sale. One of the agronomists explained to me later that the fact that they had been working in the village for some time now made all the difference; there was also a better road leading to the village, which created an opportunity for businessmen to come and buy products. It was the same pattern in the third village: the word 'radiation' got mentioned one or two times in passing, in the context of other discussions. Significantly, thus, the context of sustainable development projects provides limited context for the discussion of radiation protection measures, such as measuring radiation levels in produce; it excludes meaningful discussions related to health and bodies of laypeople: the meetings and interactions that I observed provided no opportunities to meaningfully bring up and articulate possible health effects of radiation.

***

During these trips, the team commonly ate at local restaurants. At no point did I or any team members pause to wonder whether it was safe to have lunch in that restaurant; we assumed that as part of the state infrastructure, there had been radiation control at some point. This and other restaurants—as well as snacks from food kiosks and apples offered in conversations with locals—were an absolutely 'natural,' given routine that was easy to follow and not think about. Similarly, during a preliminary trip with a friend to visit her family living in Khoiniki (originally one of the most contaminated towns), checking food for radiation was not really considered. Courtesy demanded that at a family gathering, we would eat what we were given. It appeared that very little about radiation danger could be discussed in these contexts without social consequences.

## Unarticulated Health Effects

Gould (1993) argues that effects on health are potentially more mobilizing than effects on the environment in general. However, these effects, too, have to be articulated and made visible. Establishing causality can be done through 'popular' means of comparison across the affected population, so called popular epidemiology (Brown 1992). Popular epidemiology should not be considered as an area of knowledge where popular conceptions are juxtaposed with expert conceptions; diagnosed symptoms form the basis of laypeople's judgments and comparisons; what is diagnosed and how it is diagnosed depends on available health infrastructures. In Chernobyl contexts, thyroid problems are brought up almost instantly. In a way, thyroid 'objectifies' radiation problems—to the exclusion of other health symptoms—in ways similar to objectification of radiation in mushrooms and berries. The links between radiation and thyroid have been articulated, not only in the media, but also through health examinations and health recuperation programs for children with thyroid problems: children with thyroid pathologies have been diagnosed, identified, and sent on Chernobyl-related 'health recuperation' trips abroad or to other areas of the country.

Attribution of other health symptoms is much more uncertain. During my field trips I could find no coherent articulation of any other health problem as related to radiation. A number of symptoms were connected with radiation by particular individuals, but this individual linking was always uncertain and unsupported (as can be seen below). One example is the repeated mentioning of 'bad years': years with atypically high number of funerals for a particular village. During these years, people were said to die of seemingly unrelated causes; the incidences of these years were not compared across different villages (at least one Belarusian scientist paralleled lay comments and used the same example of residents' "dying off" during a particular period as an example of radiation exposure effects on 'sensitive' groups of the population, including people with chronic illnesses). According to one woman, "We had a year once when almost every day there was a funeral. We must have buried about 50 people that year. Is it related to radiation? Who knows." The last phrase is not a question: it's a statement that acknowledges different possible positions as well as indeterminacy. This questioning of the possible link and assertion of indeterminacy appeared to be common and will come up again in the interviews described below.

The problem of attribution was also sometimes dealt with by reversing the argument and utilizing a Soviet category of 'practically healthy': instead of pointing out which illness might be related to radiation, the argument went that there were 'no healthy' children or few healthy children: unlike in the 'normal' population where some portion of children were supposed to be healthy, in Chernobyl regions, very few children were thought to be healthy. Most were said to have chronic diseases, perhaps more than one. In one of the villages visited with the CORE Program, women told me that everyone was sick, especially children: "nobody is completely healthy." Thus, statements like "there are no completely healthy children in school" reversed the logic of finding specific radiation health effects, and aggregated individual problems into the general statistics—based on the assumption that in the 'normal population' there should be some percentage of 'practically healthy' individuals.

In rare cases, the problem of uncertain attribution seemed to have been bypassed by emphasizing (perhaps exaggerated) the uniqueness of some health problems.

According to a member of an non-governmental organization: "Where else do you see 7- or 8-year olds with pace-makers?"

Overall, however, thyroids were the main health issue to be mentioned, and this might be the effect of thyroid-related health recuperation problems more than anything else. When I probed for connections that people might have observed between radiation effects and health problems in Selo (the case, described at length above), several cases of thyroid pathologies were mentioned almost immediately, all told to me by mothers of the sick children. All other opinions were either expressed by only isolated individuals or did not include any *specific* problems.  Two teachers and the librarian told me that one of their children (daughters) had various problems with their thyroids. They all had been to Italy for 'recuperation.' In fact, the younger daughter of the Head of Junior Classes was diagnosed there. The girl did not want to go again since she was "a kind of home-body." The librarian's daughter has been to Italy three times.  The children with thyroid problems used to be taken for observation to a rehabilitation center in Minsk (Aksakovschina), "unless they themselves did not want to go."

Lack of similar administrative practices for diseases other than thyroid pathologies resulted in a much less coherent articulation of other possibly related health effects.  The mathematics teacher believed that children's memory had suffered: "I've been working here for thirty-three years, and I have not seen it as bad before."  Along with memory, the school activity organizer—a young woman who came and asked to be measured for internal radiation before other teachers did—said that many schoolchildren were sick with a number of problems other than thyroid problems: chronic diseases, gastritis. She then added an opinion I later heard from a number of experts: "*I think radiation simply makes every disease chronic.*"

The saleswomen at a local shop told me that, "People get sick, but then they get some treatment (*podlechat'sa*) and they are okay." A few farmers told me, "Yes, people get sick. Depends on what they get sick with. They have flu... People don't have thyroids, no. Don't know anybody who has a thyroid."[211] A retired man outside of school, who appeared very concerned about radiation, said that, "people get sick a lot, especially older people." The last statement sounds somewhat absurd, it might be just "natural" for old people to get sick. Perhaps, by viewing this statement as 'funny,' we draw on how little common sense people are able to apply in this situation.

One of the very few things common for these different perspectives was the reference to the *impossible conditions* of being sick in the rural areas—the inadequate state of the health care infrastructure that is pointed out by almost everyone I talked to: lack of qualified personnel, hospitals too far away and overloaded. Additionally, to get medical attention, one might have to bring 'presents' (bribery):

> O.K.: Are there any radiation effects?
> Militiaman [gets visibly upset with the question, does not answer for a while]: I'll tell you. If you go to Brest or Gomel to see a doctor, you can't go there empty-handed. They won't even listen to you.

Asked if it had touched him personally, the same man replied, "No, I'm still young. But it still shows up somehow later. People are getting sick. Maybe it's because they are old, or maybe it's because of radiation." Majority of people in the village where he lives are retired, which is typical of some of the most contaminated areas.

---

[211] Thyroid cancers and thyroid pathologies are commonly abbreviated as just 'thyroid.'

**Concluding Remarks**

This is not an exhaustive list of contexts or opportunities for articulation. However, the analysis illustrates that invisible radiation and its delayed health effects are interpreted on the basis of social interactions associated with it, and these interactions are not limited to interactions with science and scientific definitions of 'risks.' Unavailability of spontaneous, commonsense interpretations creates multiple challenges for assessing radiation effects. Most importantly, the analysis shows that there are very limited interactive and dialogical opportunities for articulation and for developing a system of imagination/cultural tools to address the issues of radiation danger. There are neither enough mediational tools (including easy access to testing food supplies and internal accumulations in people), nor enough contexts that could be particularly valuable to the processes of articulation: litigation proceedings, and grassroots environmental and civic movements are both missing in Belarus.

Consequently, radiation danger interpretation is dependent on administrative actions such as, for example, monetary Chernobyl compensations ('coffin money'): the 'coffin money' is one of the indicators of the extent of radiation danger, along with other signs, such as free lunches in school, or the fact that the affected territories have a persistent problem with retaining physicians. These factors are interpreted within the context of interactions with the local administration, the national government's discourse as it appears in the media, and the discourses of international organizations working in the area.

Articulation of health effects by lay residents is, thus, affected by administrative practices of managing these health effects (Petryna 2002). I conclude with one last example that is meant to show the importance of engaging with broader expert discourses, though the work of 'appropriating' these discourses depends on the contexts in which relevant articulation work can be done. Aglaya, a local expert whose experience has been used in Chapter 6, discusses the importance of bringing up the Chernobyl problem in the following way:

> The problem should not be closed, and it should not be left alone. Because there is still radiation in wild berries, in mushrooms, and in hay... And almost every child has diseases. What is it related to? Radiation? Or, maybe it's always been like that, but we did not pay attention? This all has to be proven, and we cannot be the judges of that [*ne nam sudit'*]. But the problem cannot be closed, it should be observed and studied.

Aglaya's insistence on bringing up the issue is underlined by way of referring to the health problems. But as soon as she mentions the health problems, which is *the main rationale for why the issue should be kept visible,* Aglaya distances herself from the debate regarding whether or not radiation is the cause. It is interesting to note that the 'doubting' position appears as questions; at this point Aglaya's narrative becomes explicitly dialogical. The voices of 'others' (those doubting that radiation is the cause of the health problems) and their position are neither assimilated into Aglaya's own position, nor ignored, but rather they are kept at a distance, as another position, in the form of questions that somebody would or could ask. Subtly, Aglaya undermines her own credibility and forecloses her involvement in that discussion.

# Conclusion.

## Production of In/Visibility

This dissertation has examined interactions between a number of different social actors shaping public knowledge about Chernobyl consequences. At different levels of these interactions, *articulations* of the problem and *infrastructural solutions* are mutually shaping each other. What can be articulated depends on infrastructural mechanisms of data collection and analysis, and on availability of structural spaces for articulations. Articulations, in turn, determine further infrastructural solutions—for data collection, radiation protection of the population, as well as related socio-economic and administrative measures.

The production of invisibility described in this dissertation thus has a dual character. On the one hand, articulation is a dialogical, relative process; the production of invisibility is a response relative to other social perspectives. In this sense, the production of invisibility is specific to particular dialogues and contexts; the same proposed thresholds, for example, might be expanding visibility of a hazard in one context, but limiting it in different circumstances.

On the other hand, with infrastructural solutions based on these articulations, the areas of visibility and invisibility are no longer relative. Infrastructural solutions might disrupt data collection, preclude areas of analysis, or, more broadly, foreclose opportunities for articulation. At least some of these processes are irreversible. Indeed, Chernobyl consequences become an area of non-knowledge most explicitly as a result of infrastructural losses of data and when structural conditions lead to the lack of 'Chernobyl' experts, i.e., scientists who would publicly claim expertise in Chernobyl-related research (chapters 3 and 4). Some chapters of this dissertation emphasized problems, paradoxes, and 'double-binds' of infrastructural solutions (chapters 4 and 6). Other chapters were more concerned with the articulation processes themselves, as well as opportunities for lay and expert articulations (chapters 5 and 7). In this conclusion, I summarize the key issues addressed in the dissertation specifically from the angle of 'articulation' work and infrastructural conditions—in the theoretical context of power and knowledge.

The concept of 'articulation' is used in two senses that I propose are interrelated. First, it refers to learning the differences between presence and absence of effects, achieved with appropriate tools and conditions organized in particular ways (Latour 2004; Soneryd 2007; see chapter 7). Second, it refers to explicating the work that has to be done, as well as conditions and resources available for this work (Strauss 1985, 1988; Strauss and Corbin 1993; Schmidt and Simone 1996; Strauss and Star 1999; see chapter 5). This dissertation interprets articulation—used in either of these senses—as an interactive, dialogical process. The production of invisibility thrives in the contexts that limit articulation opportunities, including political regimes and organizational circumstances promoting secrecy (discussed below). The problem of articulating—identifying, making connections, and expressing in terms of work that has to be done—is a persistent problem in the post-Chernobyl circumstances, not only in expert, but also in broader public contexts.

Chernobyl contamination and other pervasive hazards—if made visible—call for large-scale infrastructural solutions, which are expensive (in case of Belarus, solutions deemed necessary have far exceeded the capabilities of the state). Expert and government discussions about whether or not relocations were necessary, for example, appear, to an extent, to be discussions about risks of living with radiation and costs of relocation. The perspectives advocating that the risks are minimal for economic reasons or on the basis of existing scientific knowledge are not inherently unethical, immoral, or wrong. From a dialogical approach, presence of perspectives arguing different viewpoints are indeed necessary for articulation of both (or all, if more than two) perspectives. This dissertation has illustrated, however, how unequal power positions thwart these discussions and related knowledge production processes. There are several different layers of unequal power relations in the case of Chernobyl, including those between international organizations and the local government, international and local experts, and experts and laypeople. Adequate knowledge practices are, then, not just a 'technical' matter, but a matter of resolving challenges produced by these structural conditions, ensuring democratic organization of expertise. Thus, the production of invisibility is not inherently undesirable; it might be necessary in some cases (not all imperceptible hazards have to be assumed dangerous and not all of them can be successfully mitigated). However, whether or not the problem is a significant and socially important one is, again, a public matter and a matter of democratic organization of expertise. In other words, analysis of the production of invisibility highlights the need for taking into account not only knowledges about particular hazards, but also social contexts of underlying knowledge practices.

The following example illustrates why considering knowledge production practices and power dynamics shaping these practices is particularly important in cases of imperceptible hazards. Ukrainian researcher Sergii Mirnyi—also a former Chernobyl 'liquidator' and an advisor at the National Radiation Protection Commission of Ukraine—describes the waves of media and public attention to Chernobyl in Ukraine similar to those in the Belarusian context (chapter 2): secrecy and silence in 1986-89, the information boom in the first half of the 1990s, followed by dying out of the media attention (Mirny 2004, 2008). Mirny arrives, however, to radically different conclusions. Sidestepping the controversies behind 'scientific facts,' Mirny presents these 'facts' as unequivocally stating that there are no radiation effects, which leads him to argue that all there is is 'information trauma,' i.e., unsubstantiated media discourse on Chernobyl that led to a number of adverse effects on the health of the 'Chernobyl' populations. Unlike international nuclear experts, Mirnyi arguably has no stake in the development of nuclear power, and he uses the concept of psychological trauma already widely applied by local psychologists and sociologists. The fact that Mirny could describe the post-Chernobyl processes as (just) 'information trauma' points to how obviously constructed 'Chernobyl' visibility is. In a sense, imperceptibility of radiation and the particular nature of its effects 'affords' the production of invisibility (see below). Since imperceptibility of radiation facilitates its public invisibility and its public visibility is obviously constructed, social analysis of knowledge production practices becomes particularly important. Furthermore, analysis of these practices has to be sensitive to issues of power; it appears to me that without attending to the power dynamic, social analysis itself blindly contributes both to sustaining unequal power relations and to the production of invisibility.

## Power and 'Reality' of Chernobyl Effects

As discussed in chapter 1, a phenomenon does not have to be imperceptible to be made invisible; yet imperceptibility certainly facilitates the process. Particular characteristics of the hazard itself *afford* (Gibson 1977, 1979) the production of invisibility: in addition to imperceptibility, low-dose radiation exposure is associated with health effects that are delayed in time and unspecific, which complicates establishing causal connections.

These characteristics of the hazard 'affording' the production of invisibility reflect properties of the hazard as much as they reflect history and present organization of observational practices. Consider, for example, if the international nuclear industry, local governments of the affected countries, and various groups of experts were as interested in identifying and keeping track of Chernobyl effects as, for example, the American credit industry is in identifying and keeping track of all credit-related activities. If Chernobyl data collection infrastructures were as extensive, and underlying categories as consistent, then one might expect data losses to be as minimal as well, thus ensuring a greater scope of registered effects.

In case of Chernobyl effects, what is known and not known is particularly affected by administrative practices (Petryna 2002). At the same time, following Latour's definition of reality as "that which resists" (1987)—in the sense of resisting arbitrary statements and productions (Bowker 2005)—the reality of Chernobyl consequences is in a kind of interaction with the production of invisibility. The relationship is captured in a comment by a physician who used to work with the affected populations. When asked if she believed a truly 'dramatic' wave of effects would 'come out,' she replied: “It depends on who's in charge, doesn't it?” Indeed, even easily diagnosed and observable health conditions can be made publicly invisible under conditions of institutional or political secrecy. What can be made invisible, and where reality might be 'resisting' (or, more accurately, facilitating resistance by local experts) is further illustrated in the example of thyroid cancer in children, the only Chernobyl radiation health consequence acknowledged by the international nuclear experts—after several years of discrediting the data and local expertise. For the local scientists, it simply could no longer be denied: this *typically rare* condition was demonstrated to have a great increase in the incidence rate and striking geographic distribution (the average number of thyroid cancers in children in Belarus before the accident was one per year) (Malko 1998).

**Pressure from the Top**

The production of invisibility is a cumulative process, consisting of a number of different layers corresponding to interactions between different interest groups. At some levels, invisibility is a result of strategic choices; in other cases, a consequence of particular structural conditions.

The key set of relationships determining the production of invisibility of the Chernobyl consequences is at 'the top': the relations between international organizations, the Belarusian government, and local scientists. The local government has been facing resistance from the international experts claiming minimum Chernobyl radiological effects, on the one hand, and on the other, the scope of the consequences that—if defined to the maximum—far exceeds capacities of the state (especially provided the lack of international assistance). Local scientists, in turn, have been faced with pressure from international nuclear experts and an ideologically overbearing local government. This set of relationships has been unfolding differently in different periods, coming, eventually, to closer cooperation between the UN organizations and the local government in the 2000s; cooperation based on emphasizing the socio-economic dimension of the Chernobyl problem and, implicitly, denying the presence of significant health-related radiological consequences.

These conditions create numerous processes resulting in the production of invisibility which can be grouped into two broad categories. First, knowledge production practices are subverted through various kinds of reframing of the problem (economic, ecological or, in the discourse of nuclear industry, psychological); these articulations thus a priori displace the role of the radiation factor. Second, politically induced categorical and infrastructural disruptions to data collection and analysis result in research paradoxically relying on theoretically, rather than empirically, driven approaches (including those dictated by the interests of nuclear industry). Perhaps even more importantly, techno-political conditions described above result not only in 'disappearance' of the radiation factor as a focus of research, but also disappearance of local experts publicly who would publicly claim expertise in this area.

Another layer of the production of invisibility is the expert work of establishing normative formal representations of the Chernobyl consequences (norms, thresholds, standards). The production of invisibility can be sustained here through misalignment of formal representations with respect to empirical complexity, technoscientific conditions, and actual practical circumstances. This misalignment can be resisted through articulation of constraints and conditions, the essential part of aligning formal representations. I have argued that the work of alignment is related to other types of making visible (e.g., producing and maintaining adequate technical equipment; gathering, storing, analyzing, and disseminating data, as well as making data publicly available). The work of alignment and some other technical kinds of work fundamental to making visible can only be done from particular technoscientific and bureaucratic positions, which draws attention to the importance of democratic organization of expertise, accountability of experts, and transparency of decision-making processes (Jasanoff 2003), as well as the value of oppositional experts (Brown et al. 2000).

**Resistance and Articulation 'from Below'**

Even for people living with radiation, 'experiencing' radiation and developing knowledge about its effects depends on opportunities for articulation. At the same time, as argued in chapter 6, groups of local populations might be interested in resisting articulation processes simply because the work they face when radioactive contamination is made observable far exceeds individual or family resources (including time), yet is continuous in nature. Furthermore, the problem with lay articulations might be not so much their dependence on science (Beck 1992), as lack of interactive, dialogical opportunities for articulation, and, thus, in case of Chernobyl, reliance on the administrative discourse. It cannot be assumed that local populations are necessarily the most risk-conscious, but they are more aware of what the overall context of life and work with increased levels of radiation implies.

The situation is complicated by limitations to broader civic spaces for articulation in Belarus, including lack of history of environmental protection movements, which in this case would mean prior experience of dealing with claims by industry experts, articulating counter-arguments, and developing mechanisms of civic and administrative influence. Lack of salient litigation processes related to Chernobyl consequences could also be interpreted as missing articulation opportunities.

Chernobyl-related 'foundations' and non-governmental organizations in Belarus have contributed to shaping broader public understanding of 'Chernobyl'; at the same time, their discourses and activities have been determined by their interactions with the local government, international donors, and the local opposition. The first Chernobyl-related non-governmental organizations appeared in the last years of the Soviet Union (1990-1991), growing out of the opposition movement, the Belarusian National Front. In the years that followed the transition to market economy, the number of Chernobyl NGO-s rose greatly; they became increasingly independent of the opposition, less politically motivated, and more extensive in their operations (Khvezhenko 2002).[212] Their focus became increasingly economic (the goal was often acquiring humanitarian assistance from abroad), contributing to a kind of hypervisibility of Chernobyl. [213] In the mid-1990s,

---

[212] For example, in the mid-1990s, the foundation organized by Gennadi Grushevoy "Deti Chernobylya" was sending 30,000 children a year for health recuperation abroad; in some heavily contaminated places (with levels of radioactivity from 15 Ci/km2), up to 80% of hospital drugs were supplied through Chernobyl foundations channeling assistance from abroad (Khvezhenko 2002).
[213] According to Nikitchenko, majority of the Chernobyl 'foundations' that emerged in the early and mid-1990s were "coax" (1999, 86). He mentions Belookaya's Belarusian Committee "Children of Chernobyl"

these foundations had to undergo revised state registration processes; their activities were heavily restricted by the government—partially through government-set categories that dictated, for example, what populations could receive what types of international humanitarian assistance (particularly problematic, for example, was import of drugs).

Under these new regulatory conditions conditions, the number of Chernobyl foundations has reduced dramatically, and—though they remain an important factor of the visibility of 'Chernobyl'—the kinds of articulations they can put forward remain limited. For example, the work of the Belarusian Committee “Children of Chernobyl” (BCCC) is atypical for Chernobyl organizations in Belarus and at the same time central to facilitating articulation of Chernobyl consequences: BCCC organizes annual academic conferences on Chernobyl and publishes the proceedings, thus maintaining one of the very few sources on Chernobyl research in Belarus.

In some cases, categories created by civic organizations serve to draw attention to 'Chernobyl,' even when these categories are speculative and not fully substantiated. One example comes from the activities of the Irish project 'Children of Chernobyl' (one of the few medical charity projects in Belarus). This project works with Professor Novik to provide complex cardiological surgeries for Belarusian children, and has started collecting data on radiation-related genetic and heart defects among Chernobyl-affected populations. The work of the project and Dr. Novik have been described in the "Chernobyl Heart" documentary (2003 Academy Award winner). Experts related to the project admit that, at the time when the film was being shot, they did not have data

---

and Gennadi Grushevoy’s “Children of Chernobyl” as two notable exceptions. For more on the activities of Chernobteyl-related civic organizations in Belarus, see Marples (1996).

confirming that Chernobyl exposure resulted in heart conditions. 'Chernobyl heart' is then a good example of a 'phantom category,' a category that aims to mark and even dramatize the consequences, their scope and nature, in the absence of officially recognized data. Chapter 2 has also discussed the double-edged phenomenon of *hypervisibility*—often exaggerated, stereotypical portrayals used to draw attention to 'Chernobyl,' but lacking concreteness of either solid empirical data or experience-based descriptions of life in the contaminated areas (resulting from exclusion of the perspectives of the populations living on these territories). Particular instances of 'phantom categories' or hypervisibility discourses might be at least partially a reaction to the disappearance of the Chernobyl consequences in the government and public discourse, an attempt to mobilize greater social attention—at times sacrificing concreteness and credibility.

***

This discussion has one particular implication with respect to peaceful uses of nuclear power. Based on analysis of the perspectives of international experts on Chernobyl issues—relative to perspectives of the affected populations, local government, and local scientists—it appears that their expertise is based on essentially undemocratic, 'top-down' organization of knowledge practices. Nuclear critic John Gofman, for example, writes about the lack of—as well as desperate need for—independent watchdogs in the committees establishing nuclear safety standards (1990, 1994). Regardless of whether or not nuclear power is deemed safe, and regardless of the credentials of nuclear experts, this organization of knowledge practices facilitates the production of invisibility—through highly selective criteria, exclusion of conflicting data, and silencing of resistant perspectives—and thus can be deemed inadequate.

If power is central to processes of the production of invisibility, as this research does claim, at least some of these layers are likely to be reproduced in other contexts: outside of the post-Soviet states and with other imperceptible hazards. Indeed, what is distinctive about the (post-)Soviet circumstances might be not the production of invisibility, but instead the eruption of visibility in the last years of the Soviet Union, facilitated by the collapsing of the old political regime with its power relations and its expertise, and by hopes for international assistance. From the perspective of social justice, essential for production of adequate public knowledge about invisible hazards are then conditions for civic articulation, as well as transparency, accountability, and democratic organization of the expertise. From the theoretical perspective, the key for analysis of the production of invisibility and non-knowledge might be in investigating tight connections between articulation and infrastructural solutions, as they are shaped by power relations.

# Appendix:  Data and Methodology

## The Scope of Research and General Methodological Approach

This appendix provides a description of the data and methodology used in the dissertation.  My approach to selection of the sources, collection of data, and data analysis has been guided by the grounded theory methodology (Glaser and Strauss 1967; Strauss 1970, 1987; Charmaz 1983; Strauss and Corbin 1990). This approach emphasizes analytical induction and on-going analysis of data; data analysis starts from the earliest stages of research, and data collection is directed and controlled by the emerging theory: concepts and hypotheses emerge from the data and point to next steps and sources. The criterion for what sources to use (e.g., what groups to sample) and when to stop sampling is 'theoretical saturation' of the emerged categories, defined by Glaser and Strauss as: "[N]o additional data are being found whereby the sociologist can develop properties of the category. As [s/he] sees similar instances over and over again, the researcher becomes empirically confident that a category is saturated" (1999[1967], 61). To achieve 'saturation' of the categories, the researcher seeks to uncover inconsistencies within data and collect further data on cases that could potentially contradict emergent categories. Guided by this  general methodological approach, I followed several lines of data collection:

*Human sources*.  In order to learn the range of perspectives on Chernobyl consequences, I interviewed lay people living in the contaminated territories as well as Chernobyl experts: scientists, physicians, government administrators, and members of international projects.  Interviews with lay people and observation of interactions between these groups were conducted during field trips into several areas officially classified as contaminated (the field trips and interviews are described in more detail below). The interviews guided choices of text sources, described below.

*Media and document sources*. I conducted content analysis of twenty years of Chernobyl coverage in four Belarusian newspapers in order to historically reconstruct transformations of visibility of 'Chernobyl.' The following documents were also collected and analyzed as primary sources: national and international reports on Chernobyl, radiation protection booklets, texts of Chernobyl laws and related regulations, Belarusian scientific publications and journals, and internet sites of key, relevant organizations. Many of the document sources collected (such as national reports on Chernobyl, for example) have limited distribution, and I relied on ‘expert’ interviewees (local scientists, physicians, members of international organizations, and local authorities) to learn of them and gain access to them.

## Analysis of Chernobyl Media Coverage

The best and perhaps the only available way of collecting systematic data on the transformation of the public discourse on ‘Chernobyl’ in Belarus was through analysis of the media coverage. Understanding of the overarching transformations in this discourse provided invaluable background for the analysis of interviews and documents (see below). Analysis of the media coverage was based on four national and local newspapers:

*1) Sovetskaya Belorussiya.* Current title: *Belarus Segodnya/ Sovetskaya Belorussiaya* [Belarus Today/ Soviet Belorussiya]. This is the main official newspaper, published in Russian.

**Sampling**: In order to provide the most comprehensive and accurate analysis, the sampling in this case was exhaustive, including all issues in the period 1986-2004.

**The total number of articles sampled:** 550 (their distribution across different time periods is described in table 2.1, chapter 2).

*2) Gomelskaya Pravda* [Gomel Pravda] is the main local newspaper in the most affected Gomel Region. In 1986, it was published in Belarusian and was issued five times a week, Tuesday through Saturday. Starting from 1996, it appeared four times a week, and starting form 2000, only three times a week: Tuesday, Thursday, Saturday. The language of the newspaper changed to Russian in 1998.

**Sampling**: I sampled six months (April-September) every other year, starting from 1986 and including 2004 (see the table 2.1, chapter 2). This sampling correlated with the pattern of annual Chernobyl coverage: April anniversary of the accident, and the end of the summer, which was the main agricultural season and the time for gathering mushrooms and berries, known to accumulate radiation (see chapter 6); other periods are relatively quiet in terms of Chernobyl coverage.

The National Library where I accessed the newspapers was missing a number of 1992 issues of Gomelskaya Pravda (including all May and June issues), but it did include April and July months and most of the rest of the year. To compensate for the missing months, I also studied October-December issues published that year.

**The total number of articles sampled:** 349.

*3) Ecologicheski Vestnik* [Ecological Bulletin]. This was a monthly supplement to *GP*, beginning in 1990. In 1993, it became a national newspaper, and one of its co-founders is Comchernobyl, Committee on the Problems of the Consequences of the Chernobyl Nuclear Accident. This provided a contrasting source, dedicated to addressing the issues of the Chernobyl consequences and radiation danger. Other *EV*'s cofounders included the State Committee on Ecology, Gomel Regional Soviet of People's Deputies, and the Journalistic Collective of the Regional Newspaper *Gomel'skaya Pravda*.

**Sampling**: The *EV* sample included: all available 1990 issues of EB as a GP supplement (4 issues); all April, May, August, and September issues of 1993 (the first year EB became a national newspaper); and April and the first week of May issues from 1994, 1996, 1998, and 2000. I selected April and the first week of May issues to capture the anniversary coverage in *EB*; August and September issues were chosen as part of the agricultural and mushroom season (see table 2.1).

**The total numer of articles sampled**: 226.

*4) Narodnaya Volya* was the most prominent independent newspaper in Belarus (literally translated as *People's Will*), which was established in 1995 by Iosif Seredich.[214] Narodnaya Volya started as a weekly newspaper, published in Russian and Belarusian;

---

[214] *Narodnaya Volya*'s significance as an oppositional newspaper is illustrated by the fact that 250,000 of its copies were seized on March 3 before the Presidential elections - as the copies were being delivered from a publisher in Smolensk, Russia. On the following Monday, the printer suddenly canceled the paper's contract, according to the editor, Iosif Seredich. ("Belarus fears violence in election aftermath," by Steven Lee Myers, *New York Times* journalist, in *International Herald Tribune*, Sunday, March 19, 2006).

first issue No. 1(1) appeared in July 11-17, 1995. It has been published daily, Tuesday through Saturday, starting from 2000.

**Sampling**: My sample from NV included all April-September issues (6 months) of the following years: 1995, 1996, 1998, 2000, 2002, and 2004.

**The total number of articles sampled**: 56.

### Access to the Newspapers

I accessed the back issues of the newspapers at the National Library in Minsk, Belarus, which, as far as I know, was the only place affording systematic access to the back issues of all these newspapers. All articles directly related to Chernobyl and published during the sampled periods were selected and photocopied (which facilitated their qualitative analysis, described below). Articles that, under closer inspection, appeared not to be explicitly related to the Chernobyl accident and its consequences were excluded during the coding process. *Belarus Today/Soviet Belorussiya* articles in the period 2001-2005 were accessed through online newspaper archives. To control for discrepancies between electronic and paper copies, I also browsed the paper copies of the newspaper during the four months April-July of each of these years (the online archive extended back to 2000).

Since I physically browsed through all back copies of the newspapers, it is possible that I missed certain articles. However, I am not likely to have missed many and articles missed are likely to be very small in size. This should not change the analysis of the overall tendencies described in this paper.

**Selection of Articles**

Article selection was based on one criterion: only articles directly addressing the accident and its consequences were chosen for analysis. The articles that could have been prompted by the accident (or its anniversary), but did not state the connection explicitly, or that were related to Chernobyl only indirectly were not included. For example, a number of articles in 1986 reported nuclear accidents or near-accidents happening at power stations or other facilities in Western countries (one might assume, to demonstrate, in the logic of the Cold War, that nuclear accidents are 'normal' and that other governments cover up) were not included. Similarly, if a later article described the rise of child cancers in the regions known to be contaminated but did not make the link to the accident, it was not included in the sample. Choosing articles based on these criteria was relatively straightforward for the first ten years of coverage. After that, the topic of Chernobyl acquired a set of recognizable themes and associations, which began to appear in articles not directly about the accident and its consequences. The word 'Chernobyl' became a metaphor (this is further explained in chapter 2) and could appear by itself, without any further explanations, in stories completely unrelated to the accident, e.g., an article titled "Alcoholism is worse than Chernobyl." It could be mentioned in passing (e.g., in a speech by the president), or as a symbol of hell. Topics such as 'Chernobyl benefits' or 'Chernobyl clean-up workers' could appear in practically any article, but my focus remained on the articles addressing the accident and its consequences directly.

Articles in the Belarusian newspapers cannot always be separated into such categories as 'news,' opinion pieces, and letters to the editor. All the articles (regardless of whether they could be interpreted as, for example, 'news' or 'commentary') were treated equally. To monitor the relative significance of the articles, I recorded their *size*, *rubric* and *pages* that they appeared on. The newspaper pages held particular interpretations in the Soviet period: the official news appeared on the first page of ‘SB,’ TV programs and entertainment pieces appeared on page 4. Pages two and three could contain, for example, news from the regions, propaganda items and reports.

Additional data not reflected in the final narrative of the study, but informing the analysis, included selected newspapers given to me by interviewees, Belarusian coverage of the 20th anniversary of Chernobyl in selected national newspapers, and recordings of Chernobyl-related TV shows and news segments.

**Analysis**

My analysis of the visibility of 'Chernobyl' in the media relied on both quantitative and qualitative analysis. Presence and volume of the coverage, as well as thematic foci were counted using content analysis. This analysis highlighted major themes of different periods; more nuanced analysis of the framing of the coverage (i.e., definitions of the nature of the problem) and identification of the temporal and spatial scope of the hazard were conducted through subsequent qualitative analysis.

To select codes and analyze articles, I followed the same procedures for all four newspapers. The unit of analysis was an article. I coded for recurrent themes; all identifiable themes were coded once per article. An article could have just one theme or it could have up to 19 themes (the typical length of a theme was no less than a paragraph). For example, a number of articles during the period 1989-1991 were survey stories, exploring different aspects of the Chernobyl disaster and its consequences. I arrived at an extensive list of themes (182), which were then aggregated into 52 broader (but still rather nuanced) topics and 6 groups of topics.[215] Topics and groups of topics, reflect general focus of the coverage, i.e., the attention to a particular topic, regardless of one's perspective on it. Particular transformations of discourse and the range of attitudes were captured through qualitative analysis (see below).

The articles were also coded for the *author,* if written not by a journalist, and *sources* used. These categories came to include: government officials, scientists, Chernobyl-related and ecological non-government organizations, civic foundations and oppositional groups, social scientists, and the lay public (including the affected populations).

Qualitative analysis of the coverage was done for each newspaper, with particular attention to *Sovetskaya Belorussiaya*. The overall sample of the articles (all photocopied) was divided into six time periods (see table above), and each period was analyzed separately. The qualitative analysis relied, in part, on the results of the content analysis; it was guided by identified dominant themes and topics for each time period. The goal of the qualitative analysis was thus to enrich the codes that emerged from the quantitative analysis of the data, and to contextualize and historicize their description.

---

[215] In 1990, 'SB' published full stenographic discussion of the Chernobyl question at the Sessions of the Supreme Soviet of the BSSR (running up to 8 full newspaper pages). I coded the main theme of the article as the first theme.

# Interviews and Ethnographic Observations

## Selection of Interviewees

The interview sampling aimed to include representatives of a range of different positions, expert and lay, in order to uncover a range of perspectives; it included experts with different institutional affiliations and areas of expertise, and experts and lay people living in different parts of the country ('clean' versus 'contaminated' areas).

It became apparent early on that what groups one might identify as 'relevant' to the Chernobyl problem depends on how the problem is defined. Because 'Chernobyl' had unclear and changing contours, categories of groups involved, both expert and lay, changed accordingly. In some cases, definition of the categories was at stake. For example, official criteria for inclusion into compensated groups, such as, 'liquidators' or 'the affected [persons]' has been changing dramatically and was a matter of social tension.

It has also been difficult to separate experts and laypeople. For example, some experts are also 'the affected populations'; members of civic organizations are often highly qualified physicians or scientists. At the same time, scientists or physicians who work in organizational contexts potentially related to Chernobyl (e.g., Ministry of Health, Republican Center for Oncology and Hematology, local hospitals, departments of radiobiology or radioecology) often claim absence of particular expertise other than their personal understanding. Therefore, the division into 'lay residents' and 'expert' categories below is rather tentative and is only used for the purposes of description in this Appendix.

**Expert Interviews**

The category of 'experts' here refers, rather loosely, to individuals' whose professional activities are related to Chernobyl knowledge production practices. It includes scientists, government authorities (including representatives of the State Chernobyl Committee and Ministry of Health), physicians, members of international organizations and programs, and selected members of civic Chernobyl organizations. The total number of interviews with experts, including 'local' experts, was 35.

Selection of experts to interview relied on 'snowballing' sampling. Some experts were approached at a Chernobyl-related conference held in Minsk. Interviews with experts tended to last longer than interviews with the affected populations (see below), up to three hours with follow-up sessions. Most expert interviews were one hour long (in a few cases, however, the interviewees refused to talk for longer than 10-15 minutes). The interviews were semi-structured and depended on experts' area of specialization. Compared to interviews with laypeople, it was generally easier to sustain these interviews: 'experts' were significantly more articulate on the topic. Perhaps one of the key differences between 'expert' and 'lay' interviews was the impression that 'experts' could see the point behind the conversation: the questions I was asking were meaningful to them in a practical way; in some cases, these individuals were passionate about the topic. This contrasted with most lay attitudes; lay residents of either clean or contaminated areas often appeared to be surprised by the topic of Chernobyl and appeared uninterested or resistant to talking about it.

Interviews with experts presented a different challenge. Interviews with residents were completely anonymous (in most cases, I did not know or ask for their last names), and was there in-passing, temporarily. With experts, I often sought interviews precisely because of their names and expertise. In some cases, their expertise or position was unique, which obviously complicated the issues of guaranteeing anonymity, particularly in a small country such as Belarus. These considerations led to some narrowing of my list of interviewees as well as the scope of issues addressed in particular interviews. Most expert interviews were tape-recorded; in some cases, I took hand-written notes, depending on the context and interviewees' preferences.

The interviews typically started with discussion of the history of the experts' professional involvement with their work, their understanding of the Chernobyl consequences, and relevant activities of their organization. In the second part of the interview, I sought to elucidate individuals' interpretations through presenting opposing positions (e.g., positions of the international experts, local administrators with a different perspective, etc.); this explicitly dialogical context often provided an opportunity for clearer, more explicit reflections. These reflections also tended to provide individuals' interpretations of the past histories of relevant interactions. Depending on experts' positions, I also sought their opinions on the informing of the broader public. In addition, I noted indications of experts' personal concern (or lack of concern) with radiation danger and past, present, or future Chernobyl consequences.

Sample questions for expert interviews:

- Describe the nature of your involvement with assessing the consequences and the danger of Chernobyl radiation.
- What kinds of data do you gather? How are these data gathered, stored, and analyzed? How is this data reported? With what media sources is this information shared?

- For how long have you been involved with 'the Chernobyl problem'? How has your involvement with assessing the consequences of the Chernobyl accident and the present radiation danger changed over time?

All interviews were transcribed, coded, and analyzed using the grounded theory methodological approach mentioned above.

**Interviews with Lay Residents**

Studying laypeople's perspective on the Chernobyl problem and radiation danger raised certain methodological challenges. Hardly any activities in everyday life related to radiation safety; even in cases when connections could be made, it was not always clear if they were made by the laypersons themselves. In preliminary trips to assess the scope of possible study, it appeared unlikely that I would be able to learn about laypeople's understanding of radiation danger by following them in their daily lives (this does not mean that laypeople's understandings of radiation danger were not reflected in their daily activities but that they were not made transparent by discourses or practices). Furthermore, I was faced with extensive heterogeneity within Chernobyl-affected areas, including their different levels of contamination and different histories of resettlement, as well as differing socio-economic and other conditions.

Consequently, my data collection relied on interviews and on observations conducted in the contexts where activities were explicitly related to Chernobyl, e.g. radiological assessment and meetings organized by Chernobyl projects. Most of the interviews with lay residents of the contaminated areas were conducted during trips with radiologists from the Institute for Radiation Safety "Belrad" and a team from the international CORE (COoperation for REhabilitation of the living conditions in Chernobyl affected areas in Belarus) Program. The CORE team held meetings and collected local project proposals and initiatives as part of the effort toward socio-economic rehabilitation of the areas affected by the accident. Thus, the majority, though not all, of my interviewees were people who participated in the activities of the organizations I came with. The total number of interviews with lay residents of the contaminated areas was 37 (most were 20-30 minutes long). The five interviews with resettlers were overall longer (up to an hour long). Residents of the contaminated areas were less interested in talking about radiation, especially outside of the contexts of radiological assessments or Chernobyl-related projects (see discussion in chapter 6).

The lay interviews were also semi-structured and included questions about: past and present scope of radioactive contamination in the area, individuals' own history of radiation-related activities and concerns (radiation protection measures, use of dosimeters, specialized farming techniques, limitations on forest use, use of private plots, etc.), sources of information (e.g., mass media), general understanding of radiation danger and its health effects, economic and other local effects of Chernobyl, and education of children.

Sample questions:

- Are there any particular situations that make you concerned about radiation danger?
- Is there radioactive contamination in this area? Where?
- Do you consider youself (and your children) safe from it?

For comparison purposes, I have also conducted interviews with lay residents of comparable social groups living in Minsk, the capital of Belarus, which was only affected in the period immediately following the accident. These interviews, as well as several interviews with 'liquidators' (accident clean-up workers) were used for comparative understanding. In the final text, they appear only as sporadic illustrations. In addition to the interviews and observations described above, I visited the Laboratory for Food Irradiation Detection, the Center for Hygiene and Epidemiology, Minsk; the city food markets in Minsk and in district centers in the Brest and Gomel regions, and the State Committee on Chernobyl.

## Document Analysis

International organizations' reports on Chernobyl, such as those by the World Health Organization, UNDP and UNICEF, UNICEF, UNSCEAR, IAEA, The Word Bank and the Chernobyl Forum are freely available online (selected UNICEF reports on the organization's activities in Belarus were also provided by a member of UNDP staff in Belarus). General information booklets on the international programs, such as ICRIN and CORE, were obtained from the CORE office and Comchernobyl. Belarusian national reports on Chernobyl consequences, and relevant legal documents were obtained from expert sources and Comchernobyl staff and were susequently analyzed as primary data. Other documents informing analysis in this dissertation include: 1996-2005 annual proceedings of the conference "Ecological, medical-biological, and socio-economic consequences of the catastrophe at the Chernobyl NPP," research collections published by the Center for Radiation Medicine, radiation protection booklets or publication by civil organizations, and local publications and proceedings on conferences on psychological effects of Chernobyl.

The study also utilized numerous miscellaneous sources—most often obtained from interviewees—as primary and secondary data. These sources included personal reflections or historiographic descriptions of the Chernobyl aftermath by Belarusian experts; translated volumes of Western nuclear critiques; materials from local institutes or the Belarusian-American thyroid project; documentaries (such as "Chernobyl Heart" and "Nuclear Controversies"), selected articles from the Western media (2003-2005), and a collection of folk humor about Chernobyl gathered at Russian humor sites.

## References


Adam, B. 1996. Re-vision: The Centrality of Time for an Ecological Social Science Perspective. In *Risk, environment and modernity: towards a new ecology*, ed. S. Lash, B. Szerszynski, and B. Wynne**.** London, Thousand Oaks: Sage.

_____. 1998. *Timescapes of modernity: The environment and invisible hazards.* London, New York: Routledge.

Adam, B., U. Beck, and J. van Loon. 2000. *The risk society and beyond: Critical issues for social theory*. London, Thousand Oaks: Sage.

Alestalo, M. A. 1991. *Science and the Politico-Economic System*. Helsinki: Vark-Publishing.

Alexievich, S. 1997. *Chernobyl'skaya molitva. Hronika budushchego* [Chernobyl prayer. Chronicles of the Future]. Moscow: "Ostozh'e."

_____. 1999. *Voices from Chernobyl*. Autumn Press Ltd.

Arendt, H. 1994 [1963]. *Eichmann in Jerusalem: A report on the banality of evil.* New York: Penguin Books.

Babenko, V.I. 2003. *Kak zashchitit' sebya i svoego rebenka ot radiacii. Posobie dlya roditeley.* [How to Protect Yourself and Your Child from Radiation. A Guide for Parents]. Institute of Radiation Safety "Belrad." Minsk: ODO "Znamenie."

Bakhtin, M. 1973 [1929]. *Problems of Dostoevsky's Poetics*. Translated by R. W. Rotsel. Ardis Press.

_____. 1981. *The dialogic imagination: four essays.* Austin: University of Texas Press.

Bandarzhevski, Yu. I. 2000. *Biomedical effects of radiocesium incorporated into the organism*. Minsk: Belrad.

_____. 2001. *Radioactive caesium and intrauterine fetus development.* Minsk: Belrad.

Bateson, G. 1972 *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology.* New York: Ballantine.

Beck, U. 1992 [1986]. *Risk society: towards a new modernity*. Trans. Mark Ritter. London, Newbury Park: Sage.

_____. 1995 [1992]. *Ecological Politics in an Age of Risk*. Cambridge: Polity.

_____. 1999. *World risk society.* Cambridge: Policy Press.

Beck, U., A. Giddens, and S. Lash (eds). 1994. *Reflexive modernization : politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.

*Belarus and Chernobyl: The Second Decade*. 1998. Ed. I. A. Kenik. Minsk: Ministry of Emergencies of the Republic of Belarus.

Belarus. *The Chernobyl Catastrophe Consequences in the Republic of Belarus*. National Report, 1996, ed. E.F. Konoplya and I.V. Rolevich. Minsk: Ministry for Emergencies and Population Protection from the Chernobyl NPP Catastrophe Consequences, Academy of Science of Belarus.

______. *15 Years After Chernobyl Disaster: Consequences in the Republic of Belarus and Their Overcoming*, National Report, 2001, ed. V. E. Shevchouk and V.L. Gourachevsky. Minsk: Committee on the Problems of the Consequences of the Catastrophe at the Chernobyl NPP.

______. *Chernobyl Consequences in Belarus*, National Report, 2003, ed. V. E. Shevchouk and V.L. Gourachevsky. Minsk: Propilei.

Belookaya, T.V. 2004a. On Information Strategies for the Chernobyl regions. Results of the interactive study of information needs of the affected populations. Unpublished paper.

______. 2004b. Information Needs Assessment of the Populations Affected by the Chernobyl Catastrophe, Interactive Study, March 15- April 26, 2004. Report.

______. 2004c. *Guide on the organization of the process of the scientific research and information network on Chernobyl. Interactive study of information needs of the populations affected by the Chernobyl accident*. Belarusian Committee "Children of Chernobyl," Institute of Radiology, Ministry of Health, Ministry of Education of the Republic of Belarus. Minsk.

Bertell, R. 1999. Avoidable tragedy post-Chernobyl. A Critical Analysis. *Journal of Humanitarian Medicine* II(3): 21-28.

______. 2005. Comments on the Press Release "Chernobyl; the true scale of the accident" (Joint News Release, WHO/IAEA/UNDP). Sept 10, 2005. Available online at: http://www.iicph.org.

Billig, M. 1998. *Talking of the Royal Family*. 2nd edition. London: Routledge.

Bowers, J. 1992. The Politics of Formalism. In *Contexts of Computer-Mediated Communication* ed. Martin Lea. Hassocks: Harvester.

Bowker, G. C. 2005a. *Memory Practices in the Sciences*. Cambridge, MA and London, England: The MIT Press.

______. 2005b. Cognitive Work and Material Practice. *The Journal of the Learning Sciences* 14(1), 157-160.

Bowker, G. C. and S. L. Star. 1999. *Sorting Things Out: Classification and Its Consequences.* Cambridge, MA: MIT Press.

Briggs, C. L. 2003a. Why Nation States and Journalists Can't Teach People to Be Healthy: Power and Pragmatic Miscalculation in Public Discourses on Health. *Medical Anthropology Quarterly* 17(3): 287-321.

Briggs, C. L., with Clara Mantini-Briggs. 2003b. *Stories in the Time of Cholera: Racial Profiling during a Medical Nightmare*. Berkeley: University of California Press.

Brown, P. 2000. Popular Epistemology and Toxic Waste Contamination: Lay and Professional Ways of Knowing. In *Illness and the Environment. A Reader in Contested Medicine*, ed. S. Kroll-Smith, P. Brown, and V. J. Gunter, 364-383. New York, London: New York University Press.

Brown, P., S. Kroll-Smith, and V. J. Gunter. 2000. Knowledge, Citizens, and Organizations: An Overview of Environments, Diseases, and Social Conflict. In *Illness and the Environment. A Reader in Contested Medicine,* ed. S. Kroll-Smith, P. Brown, and V. J. Gunter, 9-25. New York, London: New York University Press.

Button, G.V. 2002. Popular Media Reframing of Man-Made Disasters. A Cautionary Tale. In *Catastrophe & Culture: The Anthropology of Disaster.* Ed. S. M. Hoffman and A. Oliver-Smith. School of American Research Press.

*Chernobyl Heart.* 2003. Dir. and prod. by Maryann DeLeo.

Clarke, L. 1989. *Acceptable Risk?: Making Decisions in a Toxic Environment*. Berkeley, Los Angeles, London: University of California Press.

CORE. 2003. Declaration of principles of the CORE Programme "CO-operation for RE-habilitation of living conditions in Chernobyl Affected Areas in Belarus."

Couch, S. R. and S. Kroll-Smith. 2000. Environmental Movements and Expert Knowledge. Evidence for a New Populism. In *Illness and the Environment. A Reader in Contested Medicine*. ed. S. Kroll-Smith, P. Brown, and V. J. J. Gunter, 384-409. New York and London: New York University Press.

Cresnon, M. A. 1979. *The Un-Politics of Air Pollution. A Study of Non-Decisionmaking in the Cities*. Baltimore and London: The John Hopkins Press.

Decree on the Committee on the Problems of the Consequences of the Catastrophe at the Chernobyl NPP. Approved by the Council of Ministers, Republic of Belarus. Oct 10, 2001.

Douglas, M. 1986. *Risk Acceptibility in the Social Sciences.* London: Routledge and Kegan Paul.

______. 1994 *Risk and Blame*. London. Routledge.

Douglas, M. and A. Wildavsky. 1982. *Risk and Culture*. Berkeley: University of California Press.

Dunwoody, S. and H. P.Peters. 1992. Mass Media Coverage of Technological and Environmental Risks: a Survey of Research in the US and Germany. *Public Understanding of Science* 199-230.

*Ecologicheskie, mediko-biologicheskie i social'no-ekonomicheskie posledstviya katastrofy na ChAES v Belarusi* [Ecological, Medical-Biological, and Socio-Economic Consequences in Belarus of the Catastrophe at the Chernobyl NPP]. 1996. Ed. E.F. Konoplya and I.V. Rolevich. Minsk: Ministry for Emergencies and Population Protection from the Chernobyl NPP Catastrophe Consequences, Academy of Science of Belarus, Institute of Radiobiology of Academy of Sciences of Belarus [EMBSEP].

Edelstein, M. B. 1988. *Contaminated communities: The Social and Psychological Impacts of residential toxic exposure*. Boulder: Westview Press.

Eder, K. 1996. *The Social Construction of Nature*. London: Sage.

______. 1998. *Taming risks through dialogues*. In *Risk in the Modern Age,* ed. M.J. Cohen London: Macmillan.

Edwards, R. 2006. Chernobyl's death toll: twisting the facts. *openDemocracy*, April 26. Online at: www.openDemocracy.net

Epstein, S. 1996. *Impure Science: AIDS, Activism, and the Politics of Knowledge.* University of California Press.

Ewald, F. 1991. Insurance and Risk. In: *The Foucault Effect: Studies in Governmentality*, ed. Burchell, G., Gordon, C. and Miller, P. University of Chicago Press.

Fischer, D. 1997. History of the International Atomic Energy Agency: the first forty years. Vienna: The Agency.

Fortun, K. 2001. *Advocacy after Bhopal. Environmentalism, Disaster, New Global Orders*. Chicago and London: The University of Chicago Press.

Fortun, K. 2004. From Bhopal to the Informating of Environmentalism. Risk Communication in Historical Perspective. *OSIRIS* 19: 283-296.

Fowlkes, M. R. and P.Y. Miller. 1987. Chemicals and Community at Love Canal. In: Social and Cultural Construction of Risk. Essays on Risk Selection and Perception, ed. B.B.Johnson and V.T. Covello. p. 55-78. Dordrecht, Boston: D. Reidel Publishing.

Fujimura, J. H. 1987. Constructing 'Do-Able' Problems in Cancer Research: Articulating Alignment. *Social Studies of Science* 17(2): 257-293.

Gamson, W. A. and A. Modigliani. 1989. Media Discourse and Public Opinion on Nuclear Power: A Constructionist Approach, *The American Journal of Sociology*, 95 (1): 1-37.

Gitlin, Todd. 1980. *The Whole World Is Watching*. *Mass Media in the Making and Unmaking of the New Left.* Berkeley and Los Angeles: University of California Press.

Glaser, B. G. and A. L. Strauss. 1967. The Discovery of Grounded Theory. Strategies for Qualitative Research. NY: Aldine de Gruyter.

Goffman, E. 1974.*Frame Analysis: An essay on the Organization of Experience*. Harper Colophon.

Gofman, J. W. 1990. Radiation-Induced Cancer From Low-Dose Exposure: an Independent Analysis. 1st ed. Ed. by E. O'Connor. San Francisco, CA: Committee for Nuclear Responsibility, Inc.

______. 1994. *Chernobyl Accident: Radiation Consequences for This and Future Generations [Chernobyl'skaya avariya: radiacionnye posledstviya dlya nastoyashchego i buduschego pokolenii]*. 1st ed. Ed. by E. O'Connor. Committee for Nuclear Responsibility, Inc. Minsk: CNR Books and Vysheishaya Shkola Publishing House.

Goodwin, C. 1994. Professional Vision. *American Anthropologist* 96(3): 606-33.

Gould, K. A. 1993. Pollution and Perception: Social Visibility and Local Environmental Mobilization. 16 (2): 157-178.

Gould, P. 1990. *Fire in the rain: the democratic consequences of Chernobyl.* Baltimore: Johns Hopkins University Press.

Haraway, D. 1991. Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. In: *Simians, Cyborgs, and Women: the Reinvention of Nature,* 183-201. New York: Routledge.

Hecht, G. 1998. *The Radiance of France: Nuclear Power and National Identity after World War II.* Cambridge, MA: The MIT Press.

______. 2006. Negotiating Global Nuclearities: Apartheid, Decolonization, and the Cold War in the making of the IAEA. In: *Global Power Knowledgr: Science, Technology, and International Affairs,* ed. J. Krige and K.-H. Bath, *Osiris* 21 (July): 25-48.

Hoffman, S. M. and A. Oliver-Smith (eds). 2002. *Catastrophe & Culture: The Anthropology of Disaster.* School of American Research Press.

International Atomic Energy Agency (IAEA). 1991. The International Chernobyl Project: Assessment of Radiological Consequences and Evaluation of Protective Measures. Report by an International Advisory Committee. Vienna.

______. 2004. Nuclear Safety review for the Year 2004. Annex I. Safety related events and issues worldwide during 2004.

______. 2006. *Environmental Consequences of the Chernobyl Accident and Their Remediation. Twenty Years of Experience*. Report of the Chernobyl Forum Expert Group 'Environment.'

International Atomic Energy Agency (IAEA), World Health Organization (WHO), United Nations Development Project (UNDP). 2005. Chernobyl: The True Scale of the Accident. 20 Years Later a UN Report Provides Definitive Answers and Ways to Repair Lives. Press Release, Sept. 5.

International Chernobyl Research and Information Network (ICRIN). 2004a. *An Information Needs Assessment on the Chernobyl-Affected Population in the Republic of Belarus*. Report. Minsk: Unipack.

*International Chernobyl Research and Information Network* (ICRIN). 2004b. Minsk: Unipack.

Irwin, A.1995. *Citizen Science: a Study of People, Expertise an Sustainable Development.* London and New York: Routledge.

Jasanoff, S. 1990. *The Fifth Branch: Science Advisers as Policymakers*. Cambridge, MA: Harvard University Press.

______. 2003. Technologies of Humility: Citizen Participation in Governing Science. *Minerva* 41: 223-244.

Josephson, P. R. 1999. *Red Atom: Russia's Nuclear Power Program from Stalin to Today*. New York: WH Freeman and Company.

Kean, S. 2007. Universities Prepare for Nuclear Reaction. *The Chronicle of Higher Education* 53(13): A10.

Khvezhenko, A. 2002 (?). Vitki Chernobyl'skoy spirali [Convolutions of Chernobyl Spiral]. *Belorusskaya Delovaya Gazeta*, N.d.

Krimsky, S. and A. Plough. 1988. *Environmental Hazards: Communicating Risks as a Social Process*. Dover, MA: Auburn House.

Kroll-Smith, S. and H. Floyd. 1997. *Bodies in Protest. Environmental Illness and the Struggle over Medical Knowledge*. New York and London: New York University Press.

Kroll-Smith, S., P. Brown, and V. J. Gunter (eds). 2000. *Illness and the Environment. A Reader in Contested Medicine*. New York and London: New York University Press.

Kuchinsky, G. 1988. *Psihologiya Vnutrennego Dialoga* [Psychology of Inner Dialogue]. Minsk: University Press.

Lash, S. 2000. Risk Culture. In *The Risk Society and Beyond. Critical Issues for Social Theory*, ed. Adam, Barbara, Ulrich Beck and Joost van Loon. London, Thousand Oaks: Sage.

Lash, S., B. Szerszynski, and B.Wynne (eds). 1996. *Risk, environment and modernity: towards a new ecology***.** London, Thousand Oaks: Sage Publications.

Latour, B. 1987. *Science in Action. How to Follow Scientists and Engineers through Society*. Milton Keynes: Open University Press.

______. 1988 [1984]. *Pasteurization of France*. Transl. by A. Sheridan and J. Law. Cambridge, MA and London, England: Harvard University Press.

______. 2004. How to Talk about the Body? The Normative Dimension of Science Studies. *Body and Society* 10(2-3): 205-229.

Lobodenko, G. 2005. Professor Urji Bandarzhevsky: Science can be done anywhere. In Prinson too. *Komsomol'skaya Pravda*, August 18-24.

Long, M. 1995. Scientific explanation in US newspaper science stories. *Public Understanding of Science* 4: 119-130.

Luhmann, N. 1993 [1991]. *Risk: A Sociological Theory*. Berlin: de Gruyter.

Lupandin, V.M. 1998. Chernobyl 1996: New materias concerning Acute Radiation Syndrome around Chernobyl. In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*, ed. T. Imanaka, 108-113. Kyoto University, Research Reactor Institute, KURRI-KR-21.

Malko, M.V. 1998a. Assessment of the Chernobyl Radiological Consequences. In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*, ed. T. Imanaka, 65-89. Kyoto University, Research Reactor Institute, KURRI-KR-21.

______. 1998b. Chernobyl Accident: the Crisis of the International Radiation Community. In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*, ed. T. Imanaka, 5-17. Kyoto University, Research Reactor Institute, KURRI-KR-21.

Marples, D.R. 1986. *Chernobyl and nuclear power in the USSR***.** Basingstoke: Macmillan in association with Canadian Institute of Ukrainian Studies, University of Alberta.

_______. 1988. *The social impact of the Chernobyl disaster.* Basingstoke: Macmillan.

_______. 1996a. *Belarus: From Soviet Rule to Nuclear Catastrophe*. New York: St. Martin's Press.

_______. 1996b. Chernobyl Disaster: Its Effect on Belarus and Ukraine. In: *The Long Road to Recovery: Community Responses to Industrial Disaster,* ed. James K. Mitchell, 183-230. Tokyo, New York: United Nations University Press.

_______. 1999. *Belarus: a denationalized nation.* Harwood Academic.

Matsko, V. P. and T. Imanaka. 1998. Legislation and Research Activity in Belarus about the Radiological Consequences of the Chernobyl Accident. Historical Review and Present Situation." In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*, ed. T. Imanaka. Kyoto University, Research Reactor Institute, 28-39. KURRI-KR-21.

Matthews, A. S. Power/Knowledge, Power/Ignorance: Forest Fires and the State in Mexico: *Human Ecology* 33(6):795-820.

Matyushko, I. and G. Tsalko. 1997. *Kontent-analys osveshcheniya posledstvii avarii na Chernobyl'skoy AES v Belarusskih SMI, 1986-1996* [Content Analysis of the Press Coverage of the Consequences of the Chernobyl Accident in Belarusian Mass Media, 1986-1996], Minsk: Asveta. .

Mazur, A. 1987. Putting Radon on the Public's Risk Agenda. *Science, Technology, & Human Values* 12(3&4): 86-93.

Medvedev, Z. 1979. *Nuclear Disaster in the Urals*. Transl. George Saunders. New York: W.W.Norton & Company.

_______. 1992. *The Legacy of Chernobyl*. W.W. Norton & Company.

Miller, R. 1994. School Students' Understanding of Key Ideas about Radioactivity and Ionizing Radiation. *Public Understanding of Science* 3: 53-70.

Mirny, S. 2008. Chernobyl as Information Trauma [Chernobyl kak Informacionnaya Travma]. In *Travma: Punkty*, ed. S. Oushakine and Elena Trubina. Moscow: Novoe Literaturnoe Obozrenie.

_______. 2000. Information and Communication Factors' Impact on the Chernobyl Zone (1986-1990) Mitigation Workers' Health. ECOHSE Symposium, Kaunas, Lithuania, 4-7 October.

Mould, R. F. 1988. *Chernobyl: The Real Story*. Oxford, New York, Beijing, Frankfurt: Pergamon Press.

Mould, R. F. 2000. *Chernobyl record: the definitive history of the Chernobyl catastrophe.* Bristol, UK, Philadelphia, PA: Institute of Physics Publishing.

Murphy, M. 2006. Sick *Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers*. Durham and London: Duke University Press.

Nelkin, D. (ed). 1982. *Controversy: Politics of technical decisions*. New York: Norton.

______. (ed). 1984. *Controversy: Politics of technical decisions*. Beverly Hills, CA: Sage.

______. (ed.). 1992. *Controversy: Politics of Technical Decisions.* Beverly Hills, CA: Sage.

Nesterneko, V.B. 1998. *Chernobyl'skaya katastrofa: radiacionnaya zashchita naseleniya* [Chernobyl Catastrophe: Radiation Protection of Population]. Minsk: Belrad.

_______. 1999. *Recommendacii po radiacionnoy zashchite naseleniya i ih effektivnosti* [Recommendations on Radiation Protection of Population and Their Efficiency]. Minsk: Belrad.

_______. (N.d.) *Moi put' ot general'nogo kontstruktora mobil'noy atomnoy elektrostancii k radiacionnoy zashchite naseleniya i protivniku dal'neyshego primeneniya yadernyh tehnologii i ekspluatacii deistvuushchih AES* [My path from chief engineer of a mobile nuclear power plant to radiation protection of population and opposition to further use of nuclear technologies and operation of existing nuclear power plants]. Unpublished paper.

Nesterenko, V. B., A.V. Nesterenko, and A. Sudas. 2004. Belarusian Experience in the Field of Radiation Protection of Population. Role of Governmental and Non-Governmental Structures in Solving These Problems.

Nesvetailov, G. 1995. Changing Centre-Periphery Relations in the Former Soviet Republics: The Case of Belarus. *Social Studies of Science* 25(4): 853-871.

Nikitchenko, I. 1999. Chernobyl: How it Happened. Minsk: Labor Rights Committee.

Nowotny, H., P. Scott, and M. Gibbons. 2001. *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*. Polity..

*Nuclear Controversies*. 2003. Dir. Wladimir Tchertkoff, 34 min.

Nuclear Energy Agency (NEA). 2002. Organization for Economic Co-operation and Development. Chernobyl: Assessment of Radiological and Health Impacts. Update of *Chernobyl: Ten Years On*.

*One Decade After Chernobyl: Summing Up the Consequences of the Accident*. 1997 Summary of the Results of the Joint EC/IAEA/WHO International Conference (Vienna, 8-12 April 1996).

Paine, R. 1992. 'Chernobyl' reaches Norway: the accident, science, and the threat to cultural knowledge. *Public Understanding of Science* 1:261-280.

______. 2002. Danger and the No-Risk Thesis. In: *Catastrophe & Culture. The Anthropology of Disaster*, ed. Susanna M. Hoffman and Anthony Oliver-Smith, 67-90. Santa Fe: School of American Research Press.

Park, C. 1989. *Chernobyl. The Long Shadow*. London and New York: Routledge.

Perrow, C. 1984. *Normal Accidents: Living with High-Risk Technologies*. New York: Basic Books.

Petryna, A. 2002 *Life Exposed. Biological Citizens after Chernobyl.* Princeton and Oxford: Princeton University Press.

Phillips, S.D. 2002. Half-lives and Healthy Bodies: Discourses on 'Contaminated' Food and Healing in Post-Chernobyl Ukraine. *Food & Foodways* 10: 27-53.

Pidgeon, N., R.E. Kasperson, and P. Slovic. (eds). 2003. *The social amplification of risk.* Cambridge; New York: Cambridge University Press.

Powell, M., S. Dunwoody, R. Griffin, and K. Neuwirth. 2007. Exploring Lay Uncertainty about an Environmental Health Risk. *Public Understanding of Science* 16: 323-343.

Priest, S. H. 2001. A Grain of Truth. Lanham, MD: Rowman and Littlefield.

Proctor, R. 1995. *Cancer Wars. How Politics Shapes What We Know and Don't Know about Cancer*. New York: Basic Books.

Rajan, R. S. 2002. Missing Expertise, Categorical Politics, and Chronic Disasters. The Case of Bhopal. In *Catastrophe & Culture: The Anthropology of Disaster,* ed. S. M. Hoffman and A. Oliver-Smith, p. 238-259. School of American Research Press.

Read, P. P. 1993. *The Story of the Heroes and Victims of Chernobyl*. New York: Random House.

Rotkiewicz, M., H. Suchar, and R. Kaminski. 2001. Chernobyl: the Biggest Bluff of the 20th Century. Polish weekly *Wprost*, No. 2 (January 14). Online at: http://www.radscihealth.org/rsh/Docs/UN-Chernobyl/WPROSTChernBluff/wprost_chernobyl_bluff.htm

Schmidt, S.D. 2003. Transformation Discourse: Nuclear Risk as a Strategic Tool in the Late Soviet Politics of Expertise. *Science, Technology, & Human Values* 29(3): 353-376.

Schott, T. 1991. *The Scientific World System and the Centrality of US Science*. Pittsburgh, PA: University of Pittsburgh, Center for Social and Urban Research.

Scott, J. W. 1992. Experience. In *Feminists Theorize the Political*, ed. J. Butler and J.W. Scott, p. 22-40. New York and London: Routledge.

Shcherbak, Iu. 1989. *Chernobyl: A Documentary Story.* Trans. Ian Press. Macmillan Press in association with the Canadian Institute of Ukrainian Studies, University of Alberta.

Skryabin, A.M. 1997. 'Chelovecheski' faktor: Dozy i zashchitnye mery [The 'human' factor: Doses and protective measures]. In: *Ekologicheskaya Antropologiya*, annual edition, 47-51. Minsk, Lublin, Lodz: Belarusian Academy of Ecological Anthropology, Belarusian Committee "Children of Chernobyl," Lublin University, Lodz University.

Slovic, P. 1985. Characterizing Perceived Risk. In: *Perilous Progress: Managing the Hazards of Technology*, ed. R.W. Kates, C. Hohenemser and J.X. Kasperson. Bolder, CO: Westview Press.

______. 1987. Perception of Risk. *Science* 236:280-285.

Slovic, P., B. Fischhoff, and S. Lichtenstein. 1976. Cognitive Probabilities and Societal Risk Taking. In: *Cognition and Social Behavior,* ed. J.S. Carroll and J.W. Payne, 165-184. Potomac, MD: Erlbaum.

Soneryd, L. 2007. Deliberations on the Unknown, the Unsensed, and the Unsayable? Public Protests and the Development of Third-Generation Mobile Phones in Sweden. *Science, Technology, & Human Values* 32(3): 287-314.

*Stalker*. 1979. Dir. Andrei Tarkovsky. Screenplay by Arkadii Strugatski and Boris Strugatski. Moscow: Goskino.

Star, S. L. 1983. Simplification in Scientific Work: An Example from Neuroscientific Research. *Social Studies of Science* 13(2): 205-228.

______. 1985. Scientific Work and Uncertainty. *Social Studies of Science* 15(3): 391-427.

______. 1991. Invisible work and silenced dialogues in knowledge representation. In *Women, Work and Computerization*, ed. I. Eriksson, B. Kitchenham, and K. Tijdens, 81-92. North Holland, Amsterdam.

______. 1995. The Politics of Formal Representations: Wizards, Gurus, and Organizational Complexity. In *Ecologies of Knowledge. Work and Politics in Science and Technology*, ed. S.L. Star, p. 88-118. Albany: State University of New York Press.

______. 2006. Whose Infrastructure Is It Anyway? Unpublished paper.

Star, S.L. and A. Strauss. 1999. Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work. *Computer Supported Cooperative Work* 8: 9-30.

Stephens, S. 2002. Bounding Uncertainty. The Post-Chernobyl Culture of Radiation Protection Experts. In *Catastrophe & Culture: The Anthropology of Disaster*. Ed. S. M. Hoffman and A. Oliver-Smith, p. 91-112. School of American Research Press.

Stone, R. 2006. Inside Chernobyl. *National Geographic* 209(4), 32-53.

Strauss, A. L. 1970. Discovering New Theory from Previous Theory. In *Human Nature and Collective Behavior: Papers in Honor of Herbert Blumer*. Ed. T. Shibutani. Englewood Cliffs, NJ: Prentice-Hall.

______. 1985. Work and the division of labor. *The Sociological Quarterly* 26: 1-19.

______. 1987. *Qualitative Analysis for Social Scientists.* Cambridge University Press.

______. 1988. The articulation of project work: An organizational process. *Sociological Quarterly* 29: 163-78.

Strauss, A. L. and J. Corbin. 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* Newsbury Park, CA: Sage.

Strydom, P. 2002. *Risk, Environment and Society. Ongoing Debates, Current Issues and Future Prospects*. Buckingham and Philadelphia: Open University Press.

Tulviste, P. and J. V. Wertsch. 1994. Official and unofficial histories: The case of Estonia. *Journal of Narrative and Life History* 4: 311-329.

UN Chernobyl Forum (IAEA, WHO, FAO, UNDP, UNEP, UN-OCHA, UNSCEAR, the World Bank Group, the governments of Belarus, the Russian Federation and Ukraine). 2005. *Chernobyl's Legacy: Health, Environmental and Socio-economic Impacts and Recommendation to the Governments of Belarus, the Russian Federation and Ukraine*. Digest Report.

UN Chernobyl Forum, Expert Group "Environment" (EGE). 2005. Environmental Consequences of the Chernobyl Accident and their Remediation: Twenty Years of Experience. Report. Working material (limited distribution).

UNDP and UNICEF, with the support of UN-OCHA and WHO. 2002. *The Human Consequences of the Chernobyl Nuclear Accident. A Strategy for Recovery.* Report, 25 January.

UNICEF and Brest Regional Center of Hygiene, Epidemiology and Public Health. 2003. Report on the results of the sociological study of the health status and health way of life skills among child and adult populations in Lunentsk area, Brest Region. Brest.

UNICEF. 2003. *O sostoyanii zdorov'ya i osnotvnyh tendenciyah ego razvitiya u detskogo naseleniya Luninetskogo raiona Brestskoy oblasti.* [On the health status and its main tendencies among the child population in Lunentsk area, Brest Region]. Minsk.

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). 1988a. Report. Annex D. Exposures from the Chernobyl accident.

______. 1988b. Early effects in man of high radiation doses. Acute radiation effects in victims of the Chernobyl accident. Report, Appendix to Annex G, prepared under the supervision of A.K. Guskova.

______. 2000. *Chernobyl: Assessment of Radiological and Health Impacts*. Technical Reports.Annex J. Exposures and effects of the Chernobyl Accident .

Wallman, S. 1998. Ordinary Women and Shapes of Knowledge: Perspectives on the Contexts of STD and AIDS. *Public Understanding of Science* 7: 169-185.

Weart, S. R. 1988. *Nuclear fear: a history of images*. Cambridge, MA: Harvard University Press.

Wertsch, J. 2002. *Voices of Collective Remembering*. Cambridge University Press.

Wing, S. 2003. Objectivity and Ethics in Environmental Health Science. *Environmental Health Perspectives* 111:1809-1818.

Winner, L. 1986. On Not Hitting the Tar-Baby. In: *The Whale and the Reactor. A Search for Limits in an Age of High Technology,* 138-154. Chicago and London: University of Chicago Press.

World Bank. 2002. *Belarus: Overview of the consequences of the accident on the Chernobyl NPP and programs of overcoming the consequences.* Report for discussion with the government. April 8.

World Health Organization (WHO). 1993. *Chernobyl: Pomogaet Vsemirnaya Organizaciya Zdravoohraneniya* [*Chernobyl: WHO assistance*].

______. 1995. *IPHECA pilot project report*.

______. 2006. *Health Effects of the Chernobyl Accident and Special Health Care Programs.* Report of the UN Chernobyl Forum Expert Group "Health." Geneva.

Wynne, B. 1987. *Risk Management and Hazardous Wastes: Implementation and the Dialectics of Credibility*. Springer Verlag.

______. 1991. Knowledge in Context. *Science, Technology, and Human Values* 16 (1): 111-121.

______. 1992. Misunderstood misunderstanding: social identities and public uptake of science. *Public Understanding of Science* 1: 281-304.

______. 1993. Public Uptake of Science: a case for institutional reflexivity. *Public Understanding of Science* 2: 321-337.

______. 1996. May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide. In: *Risk, Environment, and Modernity: Towards a New Ecology,* ed. S. Lash, B. Szerszynski, and B. Wynne, 44-83. London, Thousand Oaks: Sage.

______. 2005. Reflexing Complexity. Post-genomic Knowledge and Reductionist Returns in Public Science. *Theory, Culture & Society* 22 (5): 67-94.

Yaroshinskaya, A. 1998a. Impact of Radiation on the Population during the First Weeks and Months after the Chernobyl Accident and Health State of the Population 10 Years Later. In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*. ed. T. Imanaka, 104-107. Kyoto University, Research Reactor Institute, KURRI-KR-21.

_______. 1998b. Overview of Different Information about Acute Radiation Syndrome among Inhabitants around Chernobyl. In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities* *to Assist the Sufferers by the Accident*, ed. T. Imanaka, 114-120. Kyoto University, Research Reactor Institute, KURRI-KR-21.

_______. 1998c. Problems of Social Assistance to the Chernobyl Sufferers in Russia" In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*, ed. T. Imanaka, 257-265. Kyoto University, Research Reactor Institute, KURRI-KR-21.

Zaprudnik, I. 1993. Belarus. At Crossroads in History. Boulder, San Francisco, Oxford: Westview Press.

Zgersky, M. `1998. Legal Regime of the Chernobyl Problems in the USSR, Belarus, Russia and Ukraine. In: *Research Activities about the Radiological Consequences of the Chernobyl NPS Accident and Social Activities to Assist the Sufferers by the Accident*, ed. T. Imanaka, p. 266-270. Kyoto University, Research Reactor Institute, KURRI-KR-21.

*Zhizn' posle Chernobylya: 16 let spustya* [Life after Chernobyl: 16 years later]. 2002. Conference proceedings (Minsk Oncology Clinic, 20 June 2002). Minsk: Ministry of Health.