OMNI-Net Ukraine
Child Development Programs

Elevated Population Rates of Malformations in a Region Impacted by Chornobyl Radiation
Call for a Technical Assessment and Prospects

Draft

POLISSIA INITIATIVE

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Elevated Population Rates of Malformations in a Region Impacted by Chornobyl Ionizing Radiation

POLISSIA INITIATIVE

GOALS

Investigations of Reproductive Risks and Pregnancy Outcomes
Call for a Technical Assessment and Prospects
Facilitate Research – Invitation to co-Investigators

OBSERVATIONS

Polissia is a Natural Laboratory
Stable Indigenous Population Isolate
Chornobyl Ionizing Radiation Impact on Several Generations
Persistent Increased Prevalence of Malformations
Ongoing Access to Communities and Defined Population Cohorts
Established Research Support Platforms

The facts and factors:

- persisting elevated population rates of mainly neural malformations
- the elevated malformation rates are among the highest in Europe and are highest in Polissia;
- native population of Polissia is ethnically distinct and represents a stable population isolate;
- a growing proportion of Polissia individuals represent are a third generation exposed to ionizing radiation;
- the impact of Chornobyl ionizing radiation on Rivne-Polissia is among the most severe in Ukraine;
- the transfer index of ^{137}Cs from soil to the food-chain in Polissia is among the highest in Ukraine;
- high consumption of ^{137}Cs containing edibles and wood for cooking and heating;
- long-standing OMNI-Net / Provincial Public Health partnerships.

OFFICIAL DECLARATION and INVITATION for co-INVESTIGATIONS

UKRAINE

RIVNE OBLAST ADMINISTRATION
PUBLIC HEALTH ADMINISTRATION
38, 16 Lypnia Str., Rivne, Ukraine, 33028

_____ # _____ To*:*

(Partial template of a letter addressed to foundations, agencies and academic institutions as well as to prospective co-investigators)

From: Research Centre for Radiation Medicine of the Ukrainian Academy Medicals Sciences, Public Health Administrations of the Provinces of Khmelnytsky, Rivne and Volyn and OMNI-Net/Ukraine Population Monitoring of Congenital Malformations Program.

Re: Technical Assessment and Prospects regarding investigations of elevated population rates of malformations in Polissia, Rivne and other regions of Ukraine.

We consider that there is a need for a technical assessment of the evidence from investigations by OMNI-Net Ukraine teams documenting elevated population rates of various congenital malformations, highest in Rivne Polissia, a region impacted by Chornobyl ionizing radiation. The complexity of these issues also prompts us to request the attention of international agencies, foundations, and academic institutions aiming to enhance the role of international co-investigators.
(continued)

Note: background information and supporting data are summarized in a companion Overview (Available upon request)

Overview

***Notice**: the data and information presented in this overview are privileged – please do not cite nor disseminate without written permission - **Contact: omninet@gmail.com**. Please also note that some of the information presented has been published and can be cited as indicated by the references provided.*

This overview is focused on the Polissia region of the Rivne province of Ukraine – the name "Polissia", unless specified otherwise, implies "Rivne-Polissia". **Ionizing radiation** may be abbreviated as **IR**. Names and spellings are given in Ukrainian, e.g. ***Chornobyl*** - alternative names and spellings are given in an explanatory note (see n.b. 1). Other n.b. present historic, geographic, legal and highlights relevant to this overview.

This overview consists of six parts: I., OMNI-Net International Consortium; II., High Population Neural Malformation Rates – Highest in Polissia; III., High Chornobyl Ionizing Radiation in Polissia; IV., Polishchuks – Native Population of Polissia with Characteristics of an Isolate; V., Conclusions; and VI., Explanatory Notes (n.b.).

I. OMNI-Net International Consortium

The consortium is dedicated to the *study, amelioration and prevention of developmental disorders*. Since 2000, OMNI-Net teams have conducted *population monitoring of malformation rates* in three Ukrainian provinces or oblasts (Volyn, Rivne, and Khmelnytsky). The process of implementing these goals is described in *"Birth defects surveillance in Ukraine: a process" - Wladimir Wertelecki et al. (OMNI-Net work group)* - J Appl Genet 47, 2006, 143-149) – a summary of the process of forming the OMNI-Net and its engagement with *national and international* partners and advisors.

OMNI-Net is a member of and reports malformation rates in Ukraine to Eurocat (a population-based registers for the epidemiological surveillance of congenital anomalies covering 1.5 million births in 20 countries – www.eurocat-network.eu) and ICBD (International Clearinghouse for Birth defects – www.icbdsr.org). Reports of implementations, initiatives and publications are found at our web-site IBIS (International Birth Defects Information systems – www.ibis-birthdefectes.org). For further information, please contact (werteleckiomni@gmail.com).

OMNI-Net, is a *not-for-profit international organization registered in Ukraine* – the resources for operations are contributed by provincial health care programs and by international donors and cooperative projects implemented by OMNI-Net teams. OMNI-Net centers and teams are an integral component of their respective *provincial health care systems (see* http://ibis-birthdefects.org/start/uabdp.htm).

The OMNI-Net center of Rivne Province is an integral component of the *Rivne Provincial the Diagnostic Center* (RPDC) located in the provincial capital, Rivne. The Rivne OMNI-Net team includes English competent professionals and staff that experienced in Pediatrics, Medical Genetics, fetal ultrasonography and who have access to a cross-section of other medical specialized teams and laboratories - the RPDC was established as a support structure for provincial health establishments, a structure where the most advanced medical technologies and other resources are concentrated.

Among other research projects, since 2000, OMNI-Net professionals have investigated the scope and frequency of congenital malformations described below. Another major effort, in partnership with several US University research teams, concerns the implementation of a series of NIH funded research protocols to prospectively define various aspects of Fetal Alcohol Spectrum Disorders.

OMNI-Net accomplished both of *two initial goals*. First, to create and sustain *two population registries*,- a registry of all *neonates and a registry of malformed infants*. The second goal was to establish *teams and resources to facilitate investigations of human population cohorts*. To ensure that Ukrainian data could be compared to that collected in other countries, *international standards* were adopted. Malformation population rates in Ukraine are reported by OMNI-Net to Eurocat (European consortium of 38 malformation surveillance systems) and to the International Clearinghouse for Birth Defects Surveillance and Research (ICBDSR). Following a probationary period, OMNI-Net is now a full member of these organizations. The population registry of newborns and other medical-care databases allow OMNI-Net to create, with relative ease, ad-hoc *population cohorts for investigations*. Currently, OMNI-Net teams, in collaboration with several US University research teams funded by the National Institutes of Health are investigating various aspects of the scope and burdens associated with Fetal Alcohol Spectrum Disorders in the Rivne and Khmelnytsky provinces. The concurrent investigations of population rates of malformations and of alcohol impacts on fetal-child development are synergistic and one component of other ongoing investigations of potential *long term health impacts of Chornobyl IR in Polissia*.

A detailed report concerning OMNI-Net activities in Ukraine is given in:
http://ibis-birthdefects.org/start/pdf/omnireport.pdf.

II. High Population Neural Malformation Rates – Highest in Polissia

Summarized next are the results of the *analysis of all birth in Rivne from 2000 to 2009*. Of the 150,000 births in Rivne, nearly *half were in Rivne-Polissia* (see section on Polissia). The results confirm two previous reports and further underscore that in Rivne-Polissia, the population *rates of neural malformation are among the highest in Europe*. In our view, the evidence is compelling and calls for further investigations with attention to *risk factors that may have combined synergistic impacts on fetal-child development, mainly, IR, alcohol and dietary deficiencies or less than optimal status.* Such investigations are facilitated by OMNI-Net data and teams to define population cohorts reflecting whole communities, mainly Polissia and nonPolissia villages. Notably, the Polishchuks, the native population of Polissia, (see section on Polissia) represent a *population isolate*. In our view, investigations of Polissia communities provide access to assess three *concurrent factors: a unique stable human cohort defined by ethnographic criteria; unique habitat and; 25 years of chronic exposure to significant levels of Chornobyl IR*. Also of note is that an increasing proportion of *infants born in Polissia were conceived by parents and gestated by women who themselves have been exposed to IR since their own conception*. Thus, the investigations of Polissia population (reported below), include individuals that represent a third generation exposed to protracted IR.

Abstract

***Background**: In 2000, OMNI-Net (a not-for-profit international organization registered in Kyiv and initiated with international assistance), established birth and congenital malformations (CM) population registries in Ukraine relying on methods used by a European network of CM monitoring systems (EUROCAT); in 2002, elevated rates of neural tube defects (NTD) were noted and confirmed by an analysis of 2000-2006 data. Population rates of microcephaly (MIC), a/microphthalmia (MOPH), and probably teratomas (TER), and conjoined twins (CTW) were also found to be elevated. Concurrently, these rates were noted to be higher in the Rivne Polissia region (Prypiat river marshes), consisting of the seven northern counties of the province. Six Rivne counties are officially designated as Chornobyl Ionizing Radiation (IR) impacted and all six are in the Polissia region. Polishchuks, the native inhabitants of Polissia, represent a Ukrainian ethnic sub-group with characteristics of a population isolate. **Goal**: to determine population malformation rates in severely impacted Chornobyl regions. **Objectives**: to document and analyze population CM rates, and temporal trends and to test strategies and feasibility to sub-categorize regions by county, village, family groups and levels of external and internal exposures to CIR (inhalation, ingestion, whole body IR counts), life-style (alcohol use, nutrition, occupation, dwelling). Isonomy levels (frequency of shared family surnames) characteristic of settlements in the investigated regions are used as a proxy measurement of consanguinity and shared environments. **Results**: analyses of 145,437 live-births from 2000 to 2009 demonstrate persisting elevated population rates (per 10,000 live births) of NTD, microcephaly and a/microphthalmos. These rates are significantly higher in Polissia vs. nonPolissia (26.1-16.4; 5.7-3.3; 2.9-1.1 respectively) and also are among the highest in Europe. Within Rivne, the highest NTD and MIC+MOPH rates were noted in vicinities of two nuclear power plants (34.1-31.9; 12.2-11.2 respectively) but the number of observations are few and the investigation continues. Microcephaly is a known manifestation of prenatal exposures to IR. The birth of eight CTW twin pairs and occurrence of 11 TER (both are rare anomalies) suggests an excess. Regarding known causes of neural CM, CIR levels in soil, milk, and whole body counts obtained from ambulatory patients and pregnant women were highest in the 3 most northern Polissia counties. Consumption of alcohol by pregnant women, one of the major causes of microcephaly, was less frequent in Polissia than in nonPolissia. Regarding genomic factors, family surname isonomy levels were highest in northern Polissia. **Conclusions**: these observations are sufficiently compelling to call for case-control or other prospective investigations with an emphasis on northern Polissia. Further categorizations of northern Polissia village populations by life-style, levels of IR, including WBC, along with degrees of isonomy or other estimates of consanguinity is ongoing to clarify the relative impacts of IR, alcohol and genomic factors upon the elevated CM rates observed. Three Ukrainian Provincial Public Health authorities from the impacted regions and the Research Center for Radiation Medicine of the Ukrainian Academy of Medical Sciences and OMNI-Net have issued a **call for international research, collaboration and co-investigations**.*

-- *Yuskiv N., Polishchuk S., Shevchuk S., et al.:* High Rates Of Neural Tube Defects In Ukraine. *Birth Defects Research (A), Clinical and Molecular Teratology 70:400-402, 2004*

-- *Wertelecki W.* Birth Defects Surveillance in Ukraine: a Process *in J Appl. Gen. 47, 143, 2006 Needham K,*

--*Yevtushok L, Lapchenko S, Wertelecki W, Garruto RM.* Dietary and activity patterns and implications for birth defects in the Chernobyl impacted Rivne-Polissia region of Ukraine. *American Journal of Human Biology 2009;21:261-262*

-- *Wertelecki W.* Malformations in a Chornobyl Impacted Region. *Pediatrics 125: 836-843, 2010*

Additional Comments, Figures and Tables

Location of OMNI-Net Centers

Figure 1. The location, composition and roles of OMNI-Net teams are variable. Population congenital malformations are monitored in Volyn, Rivne and Khmelnytsky. Fetal Alcohol Spectrum Disorders investigations are conducted in Rivne and Khmelnytsky oblasts. The teams in Crimea, Kherson and Zakarpattya focus on metabolic, pediatrics and medical education aspects.

Chernobyl Most Impacted Regions in Ukraine

Figure 2. After Ukraine's independence in 1991, northern areas of Rivne province (the Polissia region) were officially recognized as Chornobyl impacted.

POLISSIA and nonPOLISSIA
Two Distinct Regions of Rivne Province

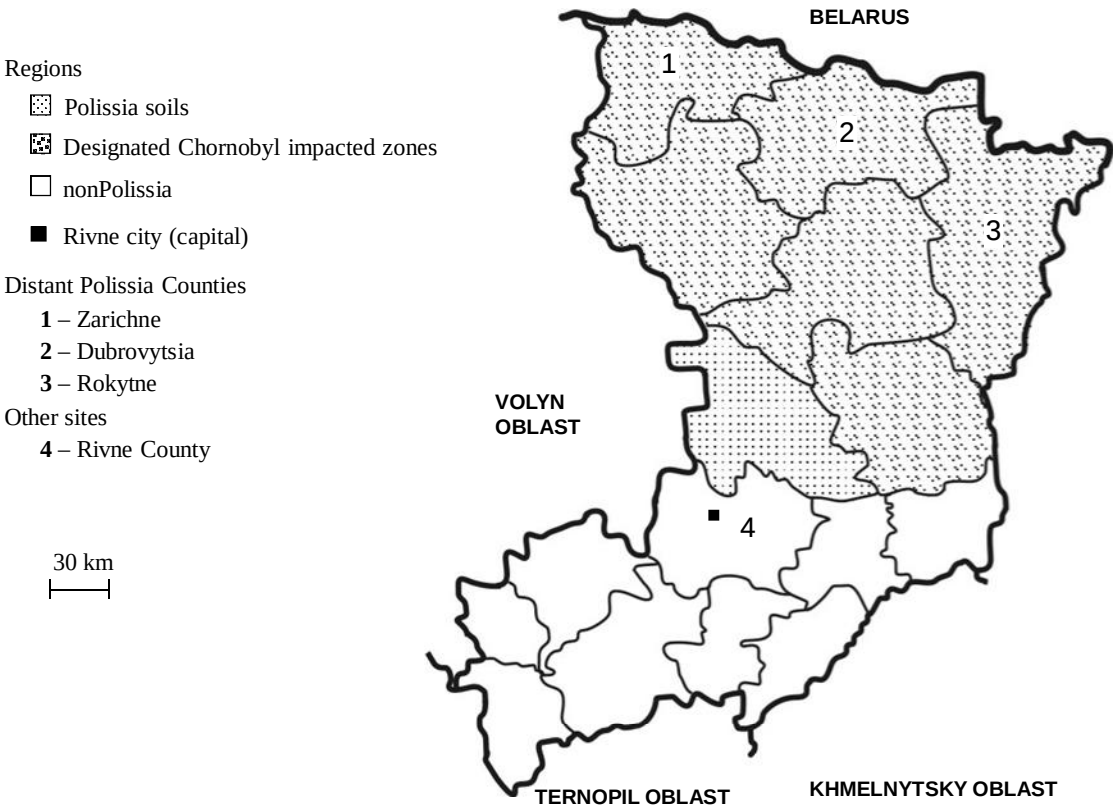


Figure 3. Historic, ethnic, demographic and soils characteristics underscore the division of Rivne province into Polissia (in gray) and nonPolissia (unshaded). There are seven Polissia counties of which six are designated as Chornobyl impacted.

Table 1. Multiple Thyroid Nodules in Polissia and nonPolissia

(Preliminary Data – Do Not Cite)

Area	Population	Multiple Thyroid Nodules[3,4]					
		10-14 years of age			15-19 years of age		
		M	F	All	M	F	All
Polissia[6]	476848	8	42	50	25	81	106
nonPolissia[7]	697826	3	2	5	6	23	29
All	1174674	11	44	55	31	104	135

[1] Rivne Pediatric Hospital (data 2000-2002).
[2] Rivne Diagnostic Center (mostly adult patients), data 1997-2011.
[3] Includes 1 female from Polissia over 19 years of age.
[4] No observations under 10 years of age.
[5] Patients' age range: 26-76 years.
[6] Excludes 10 patients of unspecified sex; 7 of unspecified date of examination.
[7] Excludes 5 patients of unspecified sex; 3 of unspecified date of examination.

Multiple Thyroid Nodules are more common among young females from Polissia - the disproportion suggests both, a likely deficiency in iodine and impacts of Chornobyl IR.

Table 2. Population Congenital Malformation Rates

Polissia vs. nonPolissia

(unpublished data – do not cite)

	Polissia**	nonPolissia	p-value	Odds ratio	L.C.L.	U.C.L.
	2000-2009					
Live births	72379***	73058***				
Neural Tube Defects	26.1 (189)	16.4 (120)	***0.001***	***1.591***	***1.259***	***2.018***
Anencephaly (a) (m1)	9.7 (70)	6.1 (45)	***0.012***	***1.573***	***1.065***	***2.338***
Isolated (m2)	7.9 (57)	5.4 (40)	***0.047***	***1.439***	***0.944***	***2.213***
Spina bifida (b) (m3)	14.1 (102)	8.2 (60)	***0.001***	***1.717***	***1.236***	***2.403***
Isolated (m2)	12.4 (90)	7.4 (54)	***0.001***	***1.683***	***1.188***	***2.405***
Encephalocele	2.3 (17)	2.1 (15)	0.420	1.144	0.537	2.460
Isolated (m2)	1.7 (12)	1.5 (11)	0.491	1.101	0.445	2.754
Microcephaly e) (m4)	5.7 (41)	3.3 (24)	***0.021***	***1.725***	***1.019***	***2.986***
Isolated (d) (m2)	1.8 (13)	n/c (8)	0.186	1.640	0.630	4.566
A-microphthalmos (e) (m5)	2.9 (21)	n/c (8)	***0.011***	***2.650***	***1.128***	***6.919***
Isolated (d) (m2)	n/c (8)	n/c (5)	0.286	1.615	0.466	6.275
Conjoined twins (m6)	n/c (2)	n/c (5)	0.936	0.404	0.038	2.466
Teratomas (m7)	n/c (7)	n/c (4)	0.269	1.767	0.449	8.229

* Rates are per 10,000 live births and counts (in parentheses) represent individuals including those with malformation syndromes and multiple malformations due to recognized, suspected or unknown causes (complex observations are described further in the Data Appendix).

** Polissia includes: Zarichne, Rokytne, Dubrovytsia, Volodymyrets, Sarny, Berezne and Kostopil counties; nonPolissia includes: Demydivka, Dubno, Hoshcha, Korets, Mlyniv, Ostroh, Radyvyliv, Zdolbuniv, Rivne counties and Rivne City; every Polissia county (except Kostopil) is officially designated as Chornobyl impacted., except Kostopil.

*** Population rates for the two time periods ods were not statistically significantly different.

(a), includes cranio-rachi-schisis and iniencephaly; (b), includes instances of ill-defined site of the schisis; (c), includes exposures to alcohol; (d), excludes exposures to alcohol; e, includes anophthalmos and microphthalmos; (m1), includes one instance of microphthalmos; (m2), excludes individuals with multiple anomalies and recognizable syndromes and causes; (m3) includes one instance of conjoined twins; (m4), includes three instances with microphthalmos (further details given in appendix); (m5), excludes one instance with anencephaly counted above; (m6), excludes one instance of spina bifida counted above; (m7), sacrococcygeal teratomas were noted in 9 individuals; n/c denotes "not computed" and implies less than 10 observations.

Neural tube defects, microcephaly and anophthalmia/microphthalmia are statistically significantly higher in Rivne-Polissia than in nonPolissia. (Confirmatory evidence for a previous report – see Pediatrics 125: 836-843, 2010

Table 3. Congenital Population Rates Computed per EUROCAT Methods
Polissia vs. Europe
(unpublished data – do not cite)

	Births	**NTD***	**Microcephaly**	**Microphthalmia**
EUROPE [a]	6,392,138	5,860 (9.2)	1,280 (2.0)	486 (0.8)
RIVNE [b]				
nonPolissia [d]	80,976	138 (17.0)	12 (1.5)	9 (1.1)
Polissia [e]	**64,461**	**165 (25.6)**	**30 (4.7)**	**18 (2.8) [c]**

* NTD: neural tube defects.

[a] EUROCAT 2000-2008 data from 31 registries - rates per 10,000 live and stillbirths: Styria, Antwerp, Hainaut, Zagreb, Odense, Paris, Strasbourg, Saxony-Anhalt, Hungary, Cork and Kerry, Dublin, SE Ireland, Campania, Emilia Romagna, North East Italy, Sicily, Tuscany, N Netherlands, Norway, Wielkopolska, S Portugal, Barcelona, Basque Country, Vaud, East Midlands and Yorkshire, NW Thames, Northern England, South West England, Thames Valley, Wales, Wessex.

[b] Rate per 10,000 live births in Rivne from 2000 to 2009.

[c] Excludes three instances of microphthalmia, one in combination with NTD and two in combination with microcephaly

[d] Chornobyl not impacted

[e] Chornobyl impacted

The rates of neural tube defects, microcephaly and microphthalmia in Polissia are higher than the average rates in Europe.

Map Illustrating Population rates of Neural Tube Defects and Birth Sites of Patients with Microcephaly and Ano/Microphthalmia

(Unreported Data – Do Not Cite)

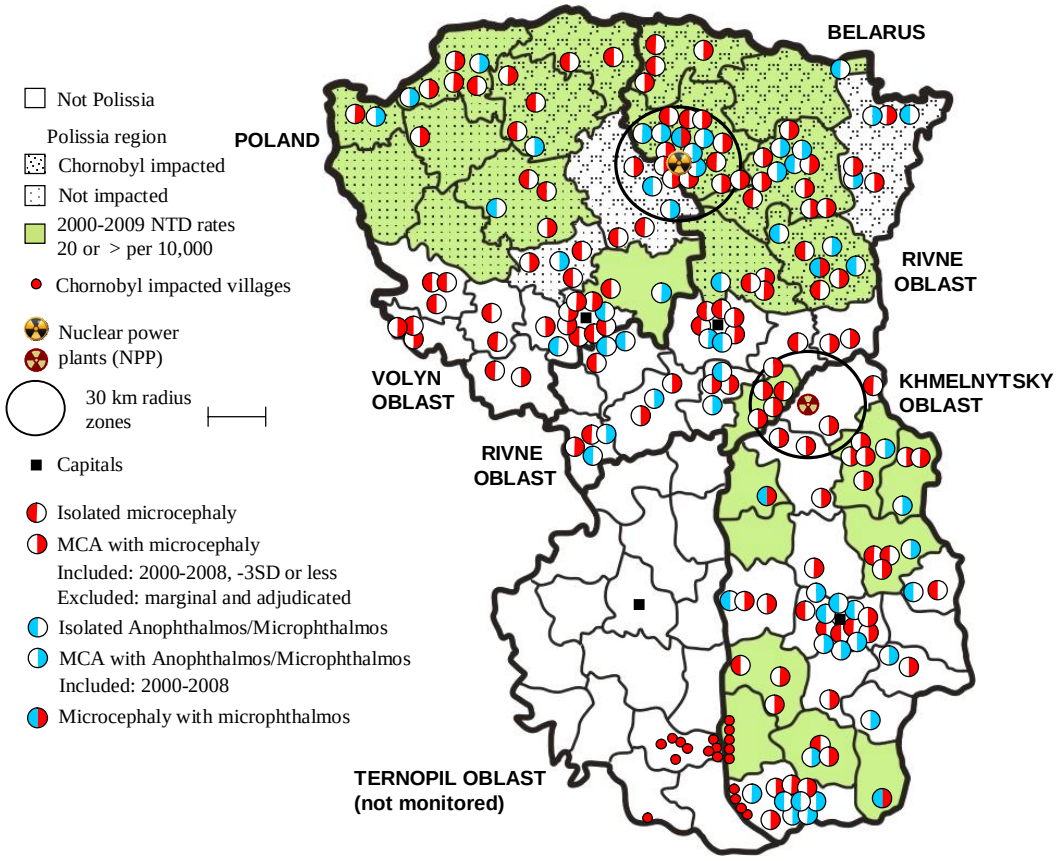


Figure 4. Map of three provinces (oblasts) showing counties (in green) with high rates of neural tube defects. The circles indicate the birth-sites of infants with microcephaly and microphthalmia. The smaller circles represent Chornobyl IR impacted villages in southern regions of the Ternopil and Khmelnytsky provinces.

Other Select Publications

"Indices of neuro-oncologial morbidity dynamics among younger children in Ukraine" Y.A. Orlov and A. V. Shaversky in Int. J. Rad. Med 2004, 6; 72-77. " … The frequency of childhood brain tumors has risen in the period 1986-2002 compared to the period 1981-1985. It is well known that IR impacts particularly the nervous system. This report suggests that monitoring of brain tumors should be a component of the "Polissia Initiative".

"Chernobyl's subclinical legacy: Prenatal exposure to radioactive fallout and school outcomes in Sweden" *D. Almond, L. Edlund and M. Palme in Q. J. Economics 2009; 124; 1729-1772* From a study of 562,637 Swedes born in the mid-1980's, the cohort in utero during the Chernobyl accident had worse school outcomes than adjacent birth cohorts. The school performance deterioration was largest for those at weeks 8-25 of gestation, when neural development is most rapid. These results demonstrate that damage to cognitive ability likely occurs at IR levels previously considered safe. In Sweden, the Chornobyl radioactive fallout was estimated at below 3 mSv. This report provides further evidence of Chornobyl impacts on the nervous system impacts detected as sub-clinical effects in lands quite distant from the Chornobyl site.

"Children Affected by the Chernobyl Nuclear Incident" *E.R. Svedsen, I.E. Kolpakov, Y.I. Stepanova et al. in Environ Health Perspect 188:720-725, 2010. Doi:10.1289/ehp.0901412* - The investigators found significant low airway obstruction and restriction in children chronically exposed to low-dose radioactive contaminants such as those found downwind of the Chernobyl Nuclear Power Plant. Impacts of IR-bearing smoke and dust on the respiratory system of children, points toward an important question for investigation.

(Impacts on other species)

"Chernobyl Birds have Smaller Brains" *A.P Mooler, A Bonisoli-Alquati, G Rudolfsen and T.A. Mousseau PLoS ONE 2011, 6, e16862* This important investigation points out that low doses IR can have significant effects on normal brain development (note similar impacts on Swedish children reported by Almond et al. cited above).

"Malformations in Lambs" *in Health Effects of Chernobyl per an Affiliate of International Physicians for the Prevention of Nuclear War, cited in page 42, as reference 115, Publisher IPPNW, Kortestrasse 10, 10967, Berlin, Germany.* Investigations by Dr. J. Steinbach from the Department of Animal Husbandry and Genetics of Domestic Animals at the University of Giessen noted that following the Chornobyl disaster, the frequency of malformations and deaths in lambs increased. Investigation of malformation rates among domestic animals in Rivne-Polissia are under consideration.

III. Chornobyl Ionizing Radiation (IR) and Polissia

Polissia is the largest region of wetlands, marshes and forested lowlands in Europe, it is also known as the Prypiat River Marshlands. The Prypiat river floodplain extends from the Ukrainian-Polish frontier some 250 miles eastward toward its confluence with the Dnipro (Dnieper in Russian). The Chornobyl (Chernobyl in Russian) disaster occurred 1986 and the site of the nuclear power plants and the adjoining "atom"-city of Prypiat is near the confluence of these rivers, some 60 miles north of Kyiv. The *Polissia soils, rich in sand and clay enhance the index of ^{137}Cs transfer from soil to the food chain.* As illustrated in Fig. xxx, six of the seven counties of Polissia are considered Chornobyl IR impacted and most areas fall in the category of "zone 3" (voluntary evacuation entitles families to some compensations – n.b. 4).

Table 4. Calculated Decrease of IR Levels in Polissia Villages

Polissia Areas	Settlements (1)								
	All	1991-1994				2003-2006			
		>0,5 mSv	>1 mSv	>2 mSv	>3 mSv	>0,5 mSv	>1 mSv	>2 mSv	>3 mSv
Distant(2)	149	148	147	124	89	139	63	19	12
nonDistant(2)	187	187	172	47	30	106	27	6	3
Total	336	335	319	171	119	245	90	25	15

The mSv values represent the highest calculated values for the site and time period – the counts represent the number of populated sites - (1), data extracted from Dosimetric Passportization of Ukrainian Settlements Contaminated by Chornobyl Disaster and from General Dosimetric Passportization in Ukrainian Settlements Contaminated by Chornobyl Disaster for the periods July1991-March 1995 (Volume 5) and 2001–2004 (Volume 10) respectively and from the General Dosimetric Passportization and Whole Body Counts (WBC) monitoring in Ukrainian Settlements Contaminated by Chornobyl Disaster for the periods 2005-2006 (Volume 11, 2007); - (2), "Distant Polissia" includes Zarichne, Dubrovytsia and Rokytne Polissia counties and "nonDistant Polissia" includes Berezne, Volodymyrets (excluding Kuznetsovsk City), Sarny and Kostopil Polissia counties.

Table IV. The number of population sites in Rivne Polissia with elevated levels of radiation exposures decreased from 1991-1994 levels to 2003-2006 levels. On the other hand and as illustrated in the following two tables, temporal changes of soil contamination levels and population malformation rates were modest if any.

Table 4. Calculated decrease of ^{137}Cs in Milk vs. Ground
Unknown impact of ^{90}Sr

Measurements		TV1**		TV2		TV3		TV4		TV5	
		A	B	A	B	A	B	A	B	A	B
Passport Dose(2), mSv/year		10.6	4.8	8.9	2.8	7.0	3.9	5.6	3.4	4.6	1.6
Average Contamination Density (soil), kBq/m^2	^{137}Cs	95	82	135	117	53	46	50	43	60	52
	^{90}Sr	2.2	n/a	1.9	n/a	24.1	n/a	6.0	n/a	7.1	n/a
^{137}Cs in Milk, Bq/L		1525	649	1237	344	993	576	767	461	615	199
Internal radiation, mSv/year		10.2	n/a	8.2	n/a	6.7	n/a	5.4	n/a	4.3	n/a

(*), estimated from level of consumption of milk, potatoes, whole body radiation counts of persons and other factors; (**), five Town/Villages (TV) with highest radiation exposures (Vezhytsia, Perekhodychi, Drozdyn, Stare Selo, Zalavia); A,B, 1991-1994 and 2003-2006 periods respectively; n/a - not available.

Calculated IR levels in five Polissia villages (TV1 to TV5) for two time period - The soil IR levels based on ^{137}Cs measurements do not show strong decrements (as illustrated in Table IV) in contrast to strong decrement in milk – Note that in TV3 the level of ^{90}Sr in the soil is nearly one half of that of ^{137}Cs and that no ^{90}Sr soil levels are reported after 1994.

Table 5. Lack of Temporal Decrement of Population Rates of Congenital Malformations

(Unreported Data – Do Not Cite)

	Polissia		nonPolissia	
	2000-2004	2005-2009	2000-2004	2005-2009
Live births	33703	38676***	33205	39853***
Neural Tube Defects	29.1 (98)	23.5 (91)	18.4 (61)	14.8 (59)
Anencephaly (a) (m1)	9.5 (32)	9.8 (38)	7.8 (26)	4.8 (19)
Isolated (m2)	7.7 (26)	8.0 (31)	6.6 (22)	4.5 (18)
Spina bifida (b) (m3)	16.6 (56)	11.9 (46)	8.4 (28)	8.0 (32)
Isolated (m2)	14.5 (49)	10.6 (41)	7.2 (24)	7.5 (30)
Encephalocele	3.0 (10)	n/c (7)	n/c (7)	n/c (8)
Isolated (m2)	n/c (7)	n/c (5)	n/c (5)	n/c (6)
Microcephaly (c) (m4)	5.0 (17)	6.2 (24)	3.3 (11)	3.3 (13)
Isolated (d) (m2)	n/c (8)	n/c (5)	n/c (3)	n/c (5)
A-microphthalmos (e) (m5)	n/c (6)	3.9 (15)	n/c (2)	n/c (6)
Isolated (d) (m2)	n/c (1)	n/c (7)	-	n/c (5)
Conjoined twins (m6)	n/c (2)	-	n/c (2)	n/c (3)
Teratomas (m7)	n/c (5)	n/c (2)	n/c (1)	n/c (3)

* Rates are per 10,000 live births and counts (in parentheses) represent individuals including those with malformation syndromes and multiple malformations due to recognized, suspected or unknown causes (complex observations are described further in the Data Appendix.

** Polissia includes: Zarichne, Rokytne, Dubrovytsia, Volodymyrets, Sarny, Berezne and Kostopil counties; nonPolissia includes: Demydivka, Dubno, Hoshcha, Korets, Mlyniv, Ostroh, Radyvyliv, Zdolbuniv, Rivne counties and Rivne City; every Polissia county (except Kostopil) is officially designated as Chornobyl impacted, except Kostopil.

*** Population rates for the two time periods ods were not statistically significantly different.

(a), includes craniorachischisis and iniencephaly; (b), includes instances of ill-defined site of the schisis; (c), includes exposures to alcohol; (d), excludes exposures to alcohol; (e), includes anophthalmos and microphthalmos; (m1), includes one instance of microphthalmos; (m2), excludes individuals with multiple anomalies and recognizable syndromes and causes; (m3) includes one instance of conjoined twins; (m4), includes three instances with microphthalmos (further details given in appendix); (m5), excludes one instance with anencephaly counted above; (m6), excludes one instance of spina bifida counted above; (m7), sacrococcygeal teratomas were noted in 9 individuals; n/c denotes "not computed" and implies less than 10 observations.

Population rates of malformations in infants born in the 2000-2004 period do not differ statistically from those born during the 2005-2009 period.

Table 7. Measured Whole Body Counts of IR of Rivne Ambulatory Patients (2009-2010)

(Unreported Data – Do Not Cite)

County	Studies	≥0,1 mSv/yr		> Norm(2)	
		%	(N)	%	(N)
Distant Polissia(3)					
<15 yrs	1231	34.93	(430)	**7.23**	(89)
Adults	6093	53.90	(3284)	**2.68**	(163)
nonDistant Polissia(3)					
<15 yrs	2671	6.51	(174)	0.67	(18)
Adults	14102	11.30	(1593)	0.11	(16)
nonPolissia(3)					
<15 yrs	984	0.10	(1)	0.00	(0)
Adults	8090	0.41	(33)	0.01	(1)

Whole Body Counts norms: ≤15 yr. is 0.31; 0.61 ^{137}Cs mSv/year for adults.
(1), patients who volunteered to undergo whole body ^{137}Cs radiation counts (Bq) while seeking services from the Rivne Regional Diagnostic Center – further comments are found as footnotes to the Table IV.

Rivne Diagnostic Ambulatory Patients Whole Body Counts (WBC) expressed as incorporated ^{137}Cs – note the different permissible IR exposures for adults and those under 15 years of age – the proportion of individuals with WBC counts above the norm, particularly if young, is significant.

Table 8. Measured Whole Body Counts of IR levels of Rivne Pregnant Women

(Unreported Data – Do Not Cite)

Residence	Studies	≥ 0,1 ^{137}Cs mSv		
		%	(N)	Mean 5 Highest(2)
Distant Polissia(3)	745	62.55	(466)	0.510
nonDistant Polissia(3)	1595	12.48	(199)	0.334
nonPolissia(4)	1340	none		0.078
Cities (5)	184	none		0.079
All	3864	17.21	(665)	

(1), data collected from pregnant women seeking prenatal ultrasound examinations at the Rivne Diagnostic Center (2008-2010); (2), average of 5 highest recordings; (3), please see footnotes in Table IV; (4), please see footnotes to Table VI; (5), Rivne and Kuznetsovsk Cities combined.

Whole Body Counts (WBC) of pregnant women receiving services for the Rivne Diagnostic Center. Note that women from Distant Polissia are more likely to have higher WBC, implying higher levels of incorporated ^{137}Cs.

Other Select Publications

"Internal Exposure from the Ingestion of Foods Contaminated by 137 Cs after the Chernobyl Accident – Report 2. Ingesion Doses of the Rural Population of Ukraine up to 12 y. after the Accident (1986-1997)". *I. A. Likhtarev, L. N Kovgan, S.E. Vavilov, et al. in Health Phys. 79, 341-357, 2000.)* The investigators indicate that *internal IR doses* calculated for various regions in Ukraine were *not based on actual measurements* of body IR of individuals but are *based on theoretical extrapolations* mostly from reports of averages of consumption of milk and potatoes contaminated in diverse degrees by radioactivity. Regarding "rural" infants consumption of milk, it was estimated from oral reports gathered from of parents of only 198 infants living in Zhytomyr oblast. *No consideration was given to Polissia* where the consumption of contaminated mushrooms and berries and burning of contaminated wood, potato stems and other vegetative matter, are extensive. (see next comment).

"Chernobyl - Consequences of the catastrophe for People and the Environment" *A. V. Yablokov, V. B. Nesterenko, A. V. Nesterenko in New York Academy of Sciences Monograph, 2009, page VIII.* In the introduction, Professor M. Grodzinsky, member of the Ukrainain National Academy of Sciences and Chairman of the Ukrainian National Commission on Radiation Protection, states that " … this publication is the largest and most complete collection of data concerning the negative consequences of Chernobyl impacts… decisions to calculate dose only on the scale of Cs-137 ionizing radiation (IR) led to *obvious underestimation of doses* (n.b. doses were defined on the basis of the activity in milk and potatoes but no consideration were made that in Polissia the consumption of these edibles is much greater that elsewhere in the country and further enhanced by high consumption of wild mushrooms and berries along with other forest products which also were not considered).

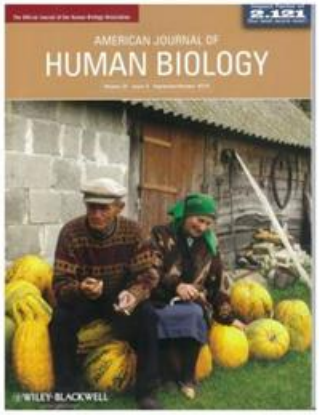
"Influence of various factors on individual ionizing radiation (IR) exposures from the Chernobyl disaster" *P. Zamostian, K.B. Moysich, M.C. Mahoney et al. in Environmental Health 1: 4, 1-8, doi 10:1186/1476-069X-1-4* The authors focus on the Ukrainian Polissia region (and in particular *Rivne-Polissia)* because; this region is the *most affected by Chornobyl*; Polissia territoires are known for their great variation in environmental and geographic conditions and therefore agricultural patterns; soils have *the highest values of soil-to-milk transfer coefficients*; residents live in small villages surrounded by forests and rely as main food sources on "free wild foods" (mostly mushrooms, berries and fish) which are known to readily concentrate radioactive elements; " … *after 1992-1994 there was a rapid increase of internal* IR exposure levels and that from 1996-2000 there was *no discernable pattern of decreasing internal IR levels* …" the authors speculate that a plausible explanation for the increase in internal IR levels relates to severe economic strains and cessation of government sponsored counter-measures (provision of "clean" dietary staples) leading to a reversion to traditional diets; people were forced to once again to consume more local produced foods and rely more on "free natural foods from forests, streams and lakes". Our own investigations are consistent with the views expressed in this report.

IV. **Polissia** and **Polishchuks**

For at least one millennium, Polishchuks represent a native population of the Prypiat Marshlands, most commonly known as Polissia. (See n.b. 2). The isolation of the Polishchuk population fostered the development of cultural characteristics and various dialects. The ecological realities were also conducive to a unique life-style, in essence, reliance of forests, lakes and rivers as sources of wood fuel for cooking and heat, wild berries, mushrooms, hunting and fishing. The Polissia habitat, since 1986 is highly contaminated by Chornobyl IR and social circumstances (poverty) forces Polishchuks to continue to rely largely on their own resourcefulness.

Figure 7. The wetlands of Polissia often require that beehives be placed high on trees.

Most pregnant women from Polissia, consume a diet containing ^{137}Cs above the permissible levels decreed by the Ministry of Health as calling for public health remediation measures. This subject is explored in our publication summarized below:



"Chronic Ionizing Radiation (IR) Exposure in the Rivne-Polissia Region of Ukraine: Implications for Birth Defects" *Kelsey Needham Dancause[1]; Lyubov Yevtushok[2]; Serhiy Lapchenko[3]; Ihor Shumlyansky[2]; Genadiy Shevchenko[4]; Wladimir Wertelecki[5]; Ralph M. Garruto1 in Am J Human Biol 22, 2010, 667-674 - presents data and interpretations of information provided by pregnant women living in Rivne-Polissia. An analysis of the data suggests that IR in this region were under-estimated. The data also suggests that exposure by inhalation is another factor that has not been sufficiently stressed in the past. Our analysis, as shown below,* ***Polissia pregnant women ingest levels of ^{137}Cs above permissible" levels*** *set by the authorities.* (See table below)

Table 9. Dietary Incorporation of ^{137} Cs by Pregnant Polissia Women

Food Type	Mean ^{137}Cs Level in Polissia (Bq/kg)	Daily Intake (kg)	Mean Daily ^{137}Cs intake in Polissia (Bq)	MOH 1997 Highest Permissible ^{137}Cs Levels (Bq)
Milk and Milk products	113.88	1.02	116.38	100.00
Meat [1]	84.45	0.19	15.71	200.00
Potatoes	31.76	0.36	11.40	60.00
Vegetables	15.71	0.28	4.38	40.00
Fruits [2]	5.73	0.13	2.21	70.00
Mushrooms [3]	13875.00	0.01	87.37	2.30
Berries [3]	2200.00	0.01	30.80	500.00
Dietary Intake			**268.25**	**200.00**

[1]Mean ^{137}Cs level is based on estimates for pork, which was the main meat consumed. Beef is estimated to have a much higher ^{137}Cs level (301.6 Bq/kg).
[2]Mean ^{137}Cs level is based on estimates for apples, which was the main fruit consumed.
[3]Mean ^{137}Cs levels based on estimates from Karachov 2006, corrected for half-life reduction since 1999.

Microcephaly and Prenatal Alcohol Exposure

In addition to ionizing radiation, another cause of ***congenital microcephaly*** is ***alcohol exposure during pregnancy***. In light of the fact that we note microcephaly rates and diminished head circumferences that are higher in Polissia; we explored the frequency of alcohol abuse in Rivne and in the adjoining Khmelnytsky provinces. Our surveys of pregnant women indicate that reduced head size measurements are unlikely to be due a greater prevalence of alcohol use by Polissia pregnant women.

Table 10. Contrasts of Proportions of Alcohol Exposed Pregnant Women

(Unreported Data – Do Not Cite)

Area/Cities[1]	Women	AE[3], % (N)	Likely AE[4], % (N)
POLISSIA[2]	852	1.53 (13)	1.29 (11)
nonPOLISSIA[2]	1417	4.73 (67)	1.34 (19)
Rivne City	566	6.36 (36)	1.41 (8)
Khmelnytsky City	1062	4.43 (47)	1.79 (19)

(1), Rivne data (14Jul2009 - 28Dec2010), in Khmelnytsky (4Jan2010 - 26Apr2011); (2), please see footnotes in Table VI; (3), "Alcohols Exposed" implies occasional alcohol consumption a month before or during pregnancy of at least ≥5 standard drinks (sd), 3 times, or 3-4 sd 4 times, or 1-2 sd ≥10 times or alternatively consuming alcohol almost daily in small amounts or alternatively, a positive answer to at least two questions that follow: "in the past year", (a) "has a friend or family member ever told you about things you said or did while drinking that you could not remember?"; (b) "have close friends or relatives worried or complained about your drinking?"; (c) "have you had a drink first thing in the morning to steady your nerves or to get rid of a hangover?"; (d) "have you felt you ought to cut down on your drinking?"; (e) "have people annoyed you by criticizing your drinking?"; (f) "have you felt bad or guilty about your drinking?"; (4), "Likely Alcohol Exposed" implies the interviewer strongly believes the woman has underreported her drinking, and is confident that if she were truthful she would qualify as a heavy or binge drinker.

Fetal Alcohol Exposure (AE) during pregnancy is less frequent in Polissia than in nonPolissia counties as well as in the capital cities of Rivne and Khmelnytsky oblasts.

Polishchuks – A Population Isolate

Polishchuks have been the subject of numerous investigations by demographers, ethnologists, linguists and historians. (See n.b. 3) However, reports concerning impacts of Chronobyl IR radiation impacts on human health, rarely make a *distinction between individuals from Polissia and nonPolissi, which in our view, is of critical importance*. For example, our investigations show that *family surnames can be characteristic of groups of villages and that the isonomy index is quite high* (proportion of shared surnames in a population – an index of the likelihood of high levels of *consanguinity)* Further investigations are needed to determine the extent that *gene mutations* that impact radiation DNA damage repair are a factor among Polishchuks, including the Nijmegen mutation known to be more frequent in these areas of Europe.

Isonomy
Shared Family Surnames
A Proxy Index of Endogamy-Consanguinity
(Unreported Data – Do Not Cite)

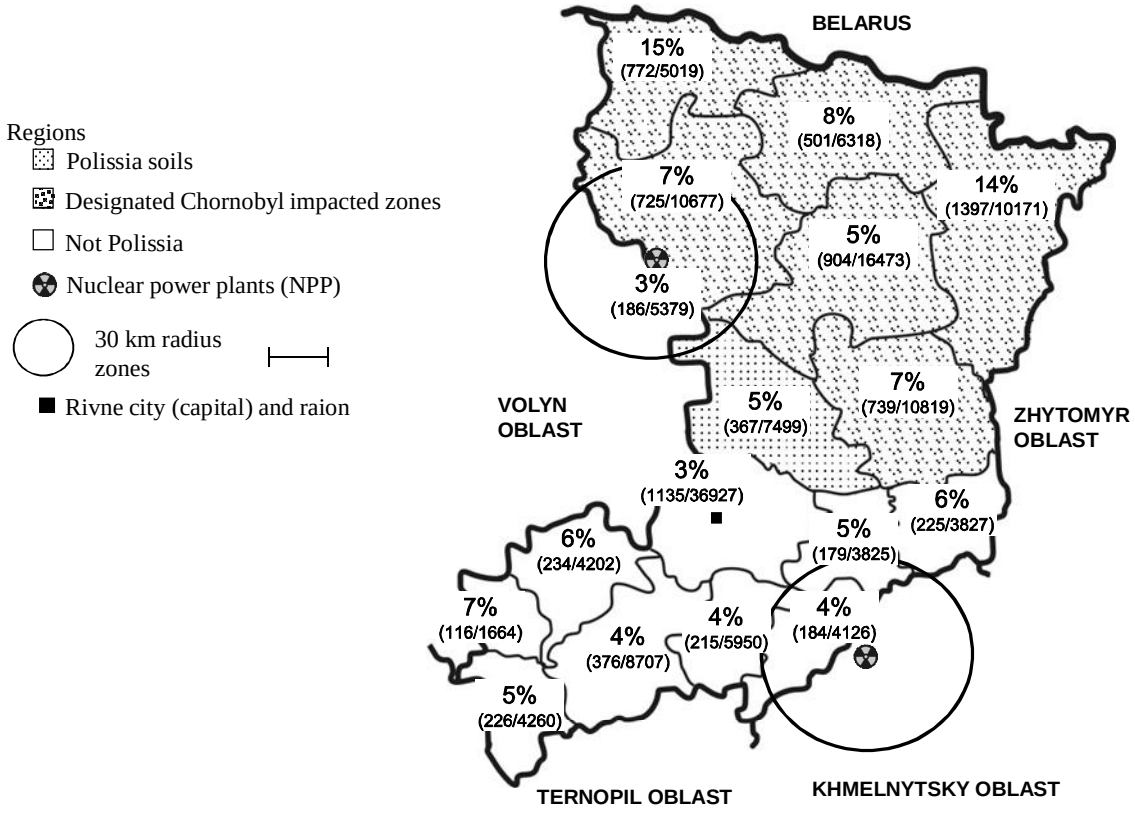
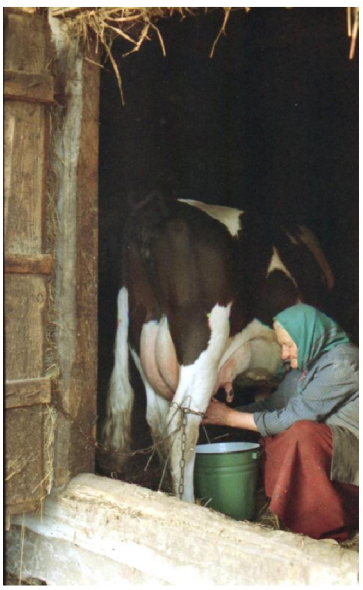


Figure 8. County isonomy levels (percent of newborns assigned any of five most common County family surnames). Note that the highest isonomy levels are found in the most northern counties of Polissia - in this overview referred to as "distantPolissia".

The Life-style of Polishchuks
Enhanced Incorporation of Ionizing Radiation

In the interest of brevity, the gallery of photographs (courtesy of Mr. O. Nahorniuk, M.D. of the Rivne Ethnology Museum) illustrates the life-style and environment of Polyshchuks in Rivne – Polissia. Illustrated are the reliance of fishing, shallow water wells, wood for cooking and heating, contaminated pastures, high consumption of milk and on women to burn biomass after harvests.



V. Conclusions

Our conclusion are:

the findings presented are sufficiently compelling to warrant a technical assessment and further investigations;

investigations of causes and mechanisms, including the impact, if any, of chronic, multi-generation exposures to low levels ionizing radiation on pre-conception and prenatal and postnatal child development;

formulation and testing of interventions to ameliorate-prevent negative impacts on pregnancy outcomes and child growth and development;

take into consideration issues relevant to other populations impacted by ionizing radiation, including those in Fukushima, Japan:

the issues are complex and multi-disciplinary in nature and co-participation by international counterparts is critical;

existing population data and access to a unique stable and defined population groups combined with already existing local research teams and resources can accelerate and reduce the cost of prospective research and prevention interventions;

the above is further facilitated by an endorsement by Public Health authorities of the Provinces of Rivne, Volyn and Khmelnitsky, the Research Center for Radiation Medicine of the Ukrainian Academy of Medical Sciences, and by OMNI-Net Ukrainian professional teams who implement the current initiative.

VI. Explanatory Notes

N.B. 1
Names, analogies and spellings

(First spelling is in Ukrainian)
Polissia, Polesie, Poliesye, Polesia, Polesye, Poles'e
Pripyat, Prepet, Pripet, Prypet, Prepyet or Pinsk Marshes or Polesian Low-lands
Polishchuks, Polesians, Pinchuks, Poleszhuk, Palyashuk, Poleshchuk, or Pleshuk.
Chornobyl, Chernobyl
Kyiv, Kiev, Kieff, Kiow
Volyn, Volinia, Volhynia, Vollinya, Vollinia
Rivne, Rovno, Ruvno
Halych, Halychyna, Halic, Galice, Gaulics, Galicia, Galizia, Galicjz, Galizien
Lviv, Lvov, Lvoff, Lemberg.
Volodymyr, Vladimir, Wladimir, Wlodzymierz, Lodomyr, Lodomiria
Buh, Bug

N.B. 2
Geographically, Polissia (Pripyat Marshes or Polesian Lowlands) with the exception of small areas in Poland and Russia, ***is located*** in northern regions of Ukraine and southern regions of Belarus. Polissia is roughly as ***large as Bavaria*** and extends from west to east some 480 km or 300 miles and from North to South, some 140 miles or 225 km to each side of the course of the Prypiat river. Polissia includes the ***largest wetlands in Europe*** and is characterized by numerous swamps, moors, lakes and ponds that undergo substantial flooding each spring. The wetlands cover about 38,000 square miles or 99,000 km^2. UNESCO Biosphere Reserves of Polissia's zones were established in Poland, Ukraine and Belarus (Pleski Park Narodowy; Shatskiy reserve and Pribuzhskoye-Polesie). Polissia extends across the northern areas of five Oblasts (from west to east, Volyn, Rivne, Zhytomyr, Kyiv and Chernihiv Oblasts or provinces). In Belarus, Polissia is found in the southern areas of four provinces (Brest, Pinsk, Kalinkavichy and Homel).

N.B. 3
History of the Region. The Primary Chronicle of Rus, compiled before the 13th Century, describes the migration of Slavic tribes and notes that the lands north of the ***Prypiat*** river (now in Belarus) were settled by Drehovichs tribes and that the lands to the south (now in Ukraine) were settled by Drevians tribes. Further south from the Drevians, the ***Vollynian*** tribes settled the area that gave rise to the Volyn Principality, now represented by ***Volyn, Rivne and Khmelnytsky*** oblasts (provinces). Historic Volyn included ***Polissia*** and extended southward from the Prypiat marshes to the Southern Bug river (not to be confused with the western Bug river that constitutes most of the frontier separating Poland from Belarus and Ukraine). Eastward, Volyn reached the Kyiv Principality and westward ***Galicia or Halych***. By the 13th Century Halych–Volyn arose and became a principality which in 1349 was absorbed by the Polish Kingdom. Several partitions of Poland led to the absorption of western Polissia-Volyn by Poland and eastern Polissia-Volyn regions by Russia. After World War II western and eastern Polissia were reunited and absorbed by the USSR. The eastern half became Rivne oblast and its capital is Rivne city and the western half became Volyn oblast and its capital is Lutsk. Only after Ukrainian independence in 1991, Rivne and Volyn Polissia regions were officially declared to be damaged by Chornobyl IR. (see

"History of Ukraine – Rus" vol. 1 by Mykhailo Hrushevsky. Canadian Institute of Ukrainian Studies Press, University of Alberta and University of Toronto – 1997 ISBN 1-8955710-19). Linguists note that Polissia dialects correlate with other cultural and historical characteristics representing archaisms peculiar to ancient tribal settlements of these regions and which have remained relatively stable for at least the last three centuries.

Mythology, Folklore and other aspects of traditional Polishchuk culture have been extensively studied by Ukrainian ethnologists. Of particular interest in the context of this review is an authoritative review of the role of the ***Polissia-Midwife*** by Dr. Olena Boriak, from the Rylskyj Institute of Folklore and Ethnology of the Ukrainian National Academy of Sciences (in the J. Slavic East Europ. Folklore Assoc. - ISSN 1920-0242).

Chornobyl city and Prypiat town.

Chornobyl city is an ancient city located on the banks of the river ***Prypiat*** and is mentioned in 1193, as an important site of the Duchy of Kiev. The name Chornobyl means "mugwort" or wormwood (Artemisia), which grows in abundance in this area. Historically, the main economic activities centered on fishing, harvesting timber and peat and collecting mushrooms and berries as is the case today in ***Rivne-Polissia***. Following the nuclear disaster in Prypiat in 1986, this historic city fell within the "exclusion zone", its 17,000 inhabitants were evacuated and Chornobyl became a ghost town.

Prypiat Town, now also a ghost town, arose in 1970 along with the V. I. Lenin nuclear plant. The plant was renamed Chornobyl and the city became Prypiat. Like other "atom-towns", Prypiat arose to house workers of the adjacent nuclear plant, its population at the time the explosion reached 50, 000, all of whom were evacuated, transforming Prypiat into a ghost town. The replacement town of Prypiat is Slavutych, built after 1986 to accommodate scientists and workers who continue to work in the Chornobyl nuclear plant.

Other *"Atom-towns" - Prypiat, Kuznetsovsk and Netishyn* are relevant to the regions described in this overview. Under the USSR, **"atom-towns**" or "atom-horodoks" had special priviledges and were populated by people from all areas of the USSR. Then and to some degree currently, these towns are exempt from subordination to oblast-regional authorities. Until the independence of Ukraine in 2001, "atom-towns" did not report infants with malformations to regional health authorities – instead, the reporting was directed to the Atomic Energy Agency and Ministry of Health - currently, health programs of "atom-cities" are dually funded by these agencies.

N.B. 4

1991 Law Decree "Regarding Status and Social Protection of Persons who Suffered from Chornobyl Catastrophe (extract) Article 2. ***Definition of zones of radioactively polluted territories***. *(unofficial informal translation by Ministry of Health teams)*

According to landscape and geochemical peculiarities of soils, measurements exceeding limit levels of natural pre-fault radionuclide accumulation in the environment, … taking into account common manufacturing, social and living activities, the territory which has been radioactively polluted by the Chornobyl catastrophe is divided into zones. The zones are:

Zone 1 - Disposal zone – territory from which the whole population was evacuated in 1986;

Zone 2 - Zone of unconditional (compulsory) resettlement – territories intensively polluted by long-life radionuclides with ground pollution density exceeding prefault situation by Cs isotopes 15.0 Ci/km2 and above or Sr isotopes 3.0 Ci/km2 and above or Pu isotopes 0.1 Ci/km2 and above, where calculated effective equivalent dose of human IR (radionuclide plant migration and other factors are taken into account) can exceed 5.0 mSv (0.5 rem) per year in excess of a doze a person could get in prefault period;

Zone 3 - Zone of guaranteed voluntary resettlement – territory with ground pollution density exceeding prefault situation by ***Cs isotopes 5.0-15.0 Ci/km2 or Sr isotopes 0.15-3.0 Ci/km2 or Pu isotopes 0.01-0.1 Ci/km2*** where calculated effective equivalent dose of human IR (radionuclide plant migration and other factors are taken into account) can exceed 1.0 mSv (0.1 rem) per year in excess of a doze a person could get in prefault period;

Zone 4 - Zone of enhanced radio-ecological control – territory with ground pollution density exceeding prefault situation by Cs isotopes 1.0-5.0 Ci/km2 or Sr isotopes 0.02-0.15 Ci/km2 or Pu isotopes 0.005-0.01 Ci/km2 under condition that calculated effective equivalent dose of human irradiation (radionuclide plant migration and other factors are taken into account) exceeds 0.5 mSv (0.05 rem) per year in excess of a doze a person could get in prefault period.

… Criteria for zone division are defined by the National Commission on IR Protection of Ukrainian Population. Zone borders are defined and reviewed by the Cabinet of Ministries of Ukraine based on expert conclusions of the National Commission on IR Protection of Ukrainian Population, National Academy of Sciences of Ukraine, specifically designated central executive agencies in the fields of health care, elimination of Chornobyl catastrophe consequences, agrarian policy, environment protection following submissions of regional soviets and followed by Verkhovna Rada of Ukraine approval. The list of settlements belonging to each radioactive pollution zone and data of ***annual dosimetric categorization*** indicating estimated population irradiation should be issued by the Cabinet of Ministers of Ukraine once every three years beginning in 2009. Zone maps, list of settlements in each zone and annual dosimetric categorization data with estimated population irradiation levels should be published every three years in national and regional printing mass media and should be kept in respective central and local state agencies.

Extract of Decree regarding Polissia - Cabinet of Ministers of Ukraine - Decree - 25th of December of 1988 – Number 2068 - Kyiv.

Re: Determinations regarding the Territories of Polissia in Ukraine.

To implement the Decree of the President of Ukraine of the 18th of June Number 652 (652/98) The Cabinet of Ministers of Ukraine mandates:...

V. Pustovoitenko, Prime Minister of Ukraine

List of Territories belonging to Polissia:

Volyn Oblast

Kamin-Kashyrsky, Kovel, Liubeshiv, Liuboml, Manevychi, Ratne, Rozhyshche, Stara Vyzhva, Turiysk, Shatsk raions, northern part of Volodymyr-Volynsky raion, part of Kivertsi raion (excluding southern and south-western parts) and the very northern part of Lokachi raion

Rivne Oblast

Berezne, Volodymyrets, Dubrovytsia, Zarichne, Kostopil, Rokytne, Sarny raions, northern part of Hoshcha, Korets and Rivne raions, southern part of Dubno and Radyvyliv raions and some small areas on the south of Ostroh raion.

End