HEALTH OF SURVIVORS IN UKRAINE IN 25-YEARS DYNAMICS AFTER THE CHERNOBYL CATASTROPHE

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Association " Physicians of Chernobyl"

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The Chernobyl reactor explosion

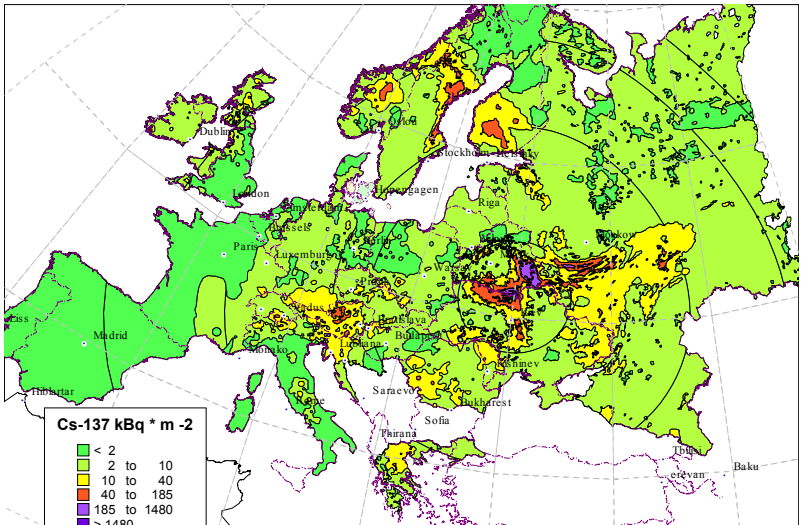
Radioactive pollution in the world after Chernobyl catastrophe

- **17 European countries**

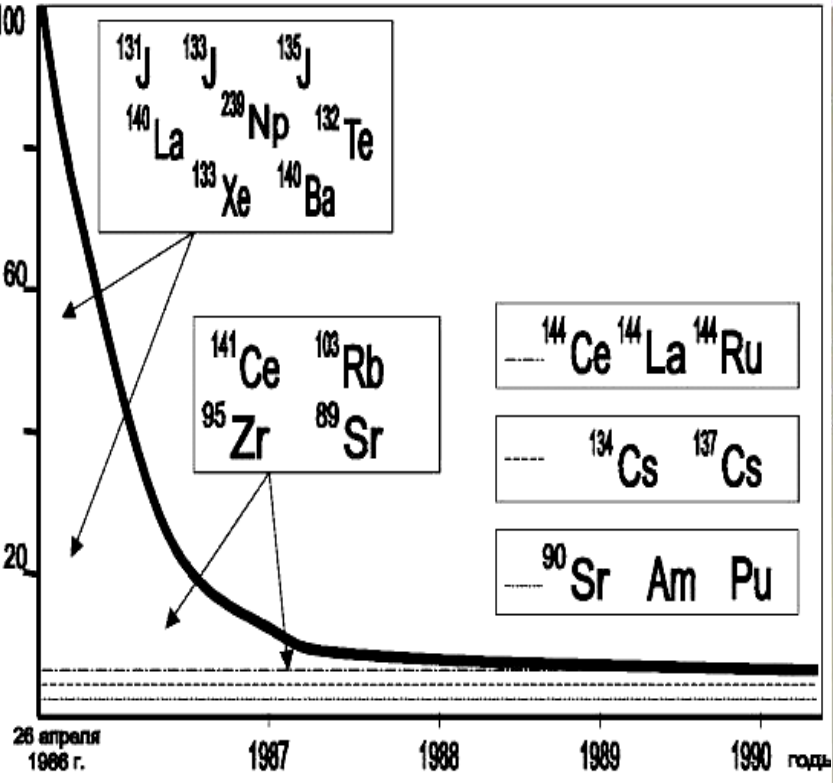
– 207 thousand squ. km

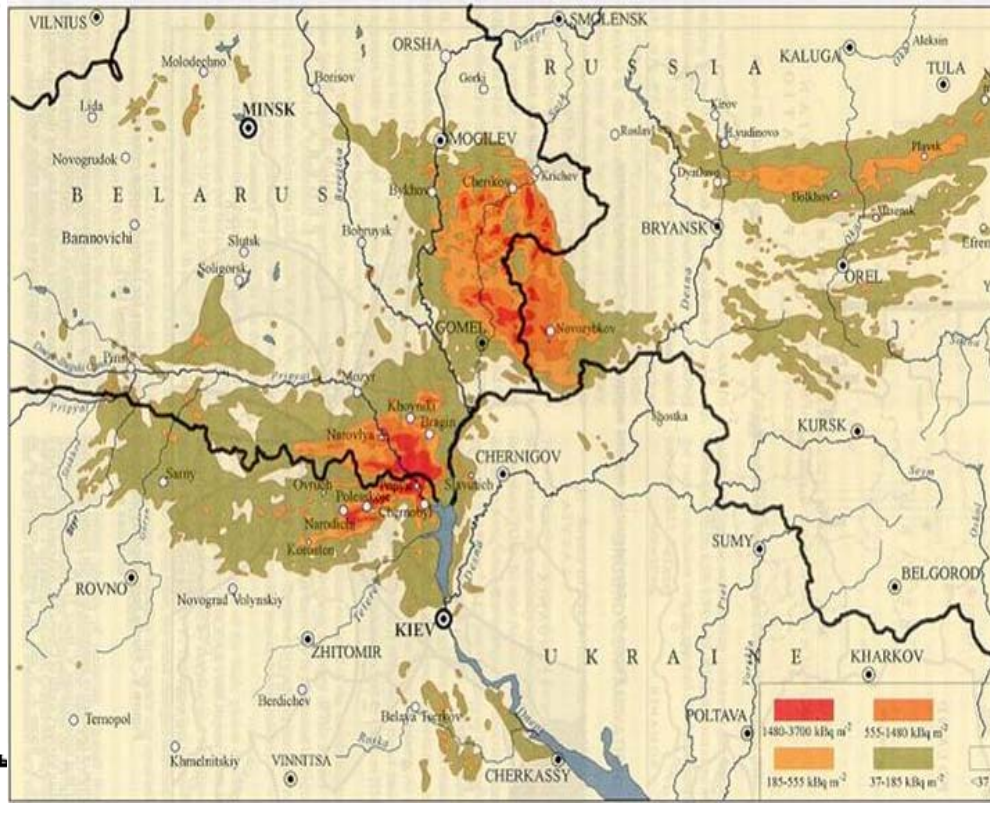
- **Belarus – 43, squ. km;**
- **RF – 56 squ. km,**
- **Ukraine– 53,4 squ. Km**
- **On others Eurasian, North of America and Africa lends fall out more than 55% Chernobyl radionuclides.**

The map of density ^{137}Cs over the Europe

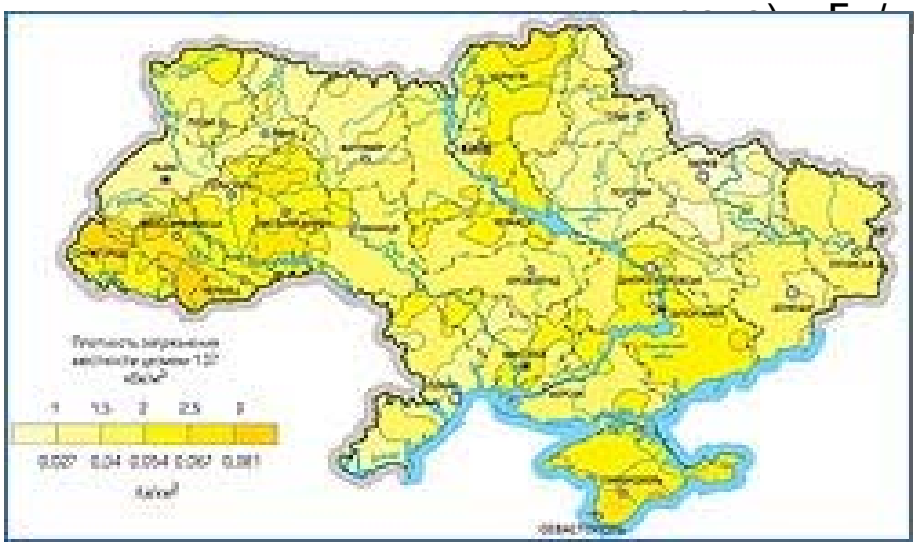


Chernobyl = 400 nuclear bombs, downcast on Hiroshima.

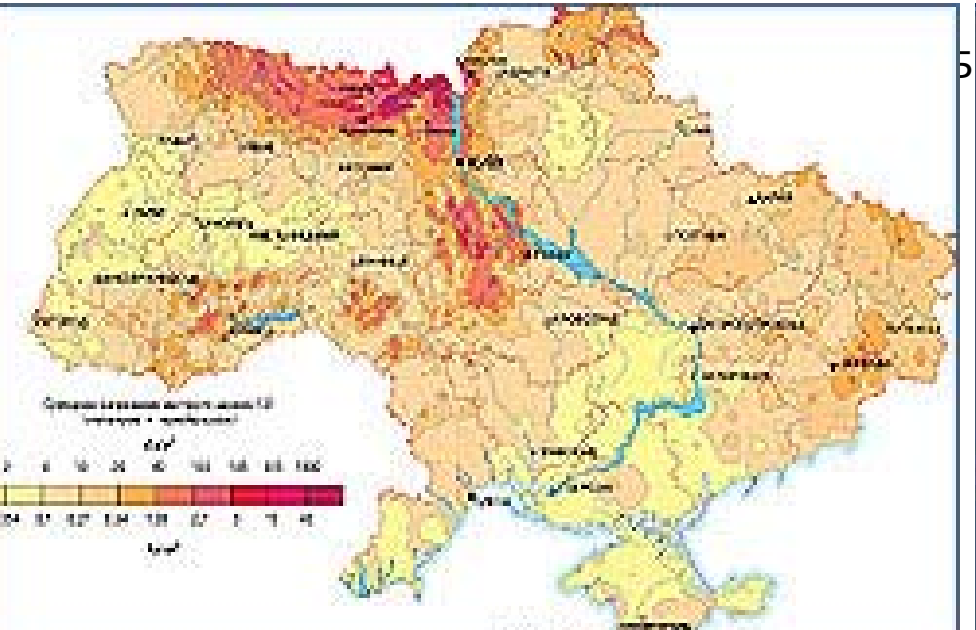


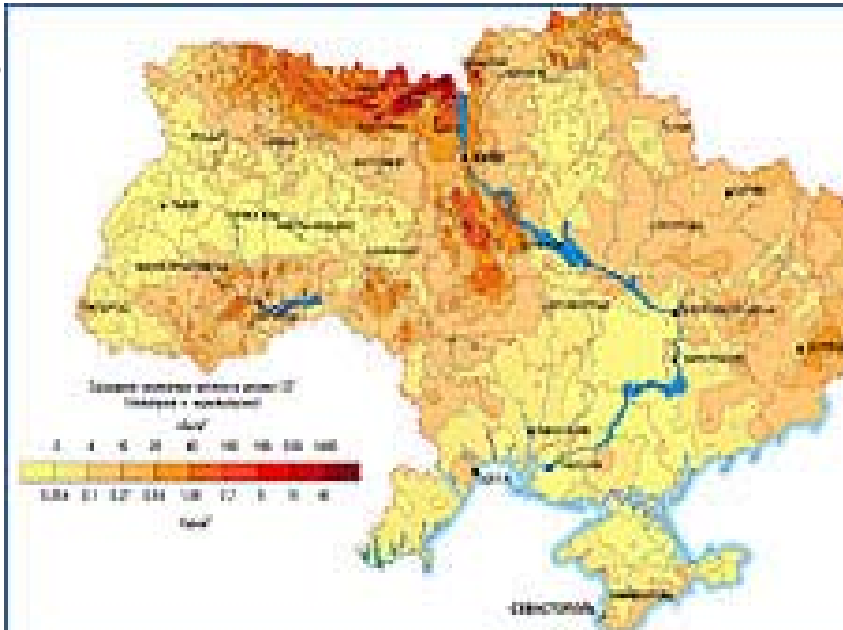


atio of isotopes: 90Sr- 1:87; 137Cs -1:890; 131I - 1:251; 33Xe- 1:31

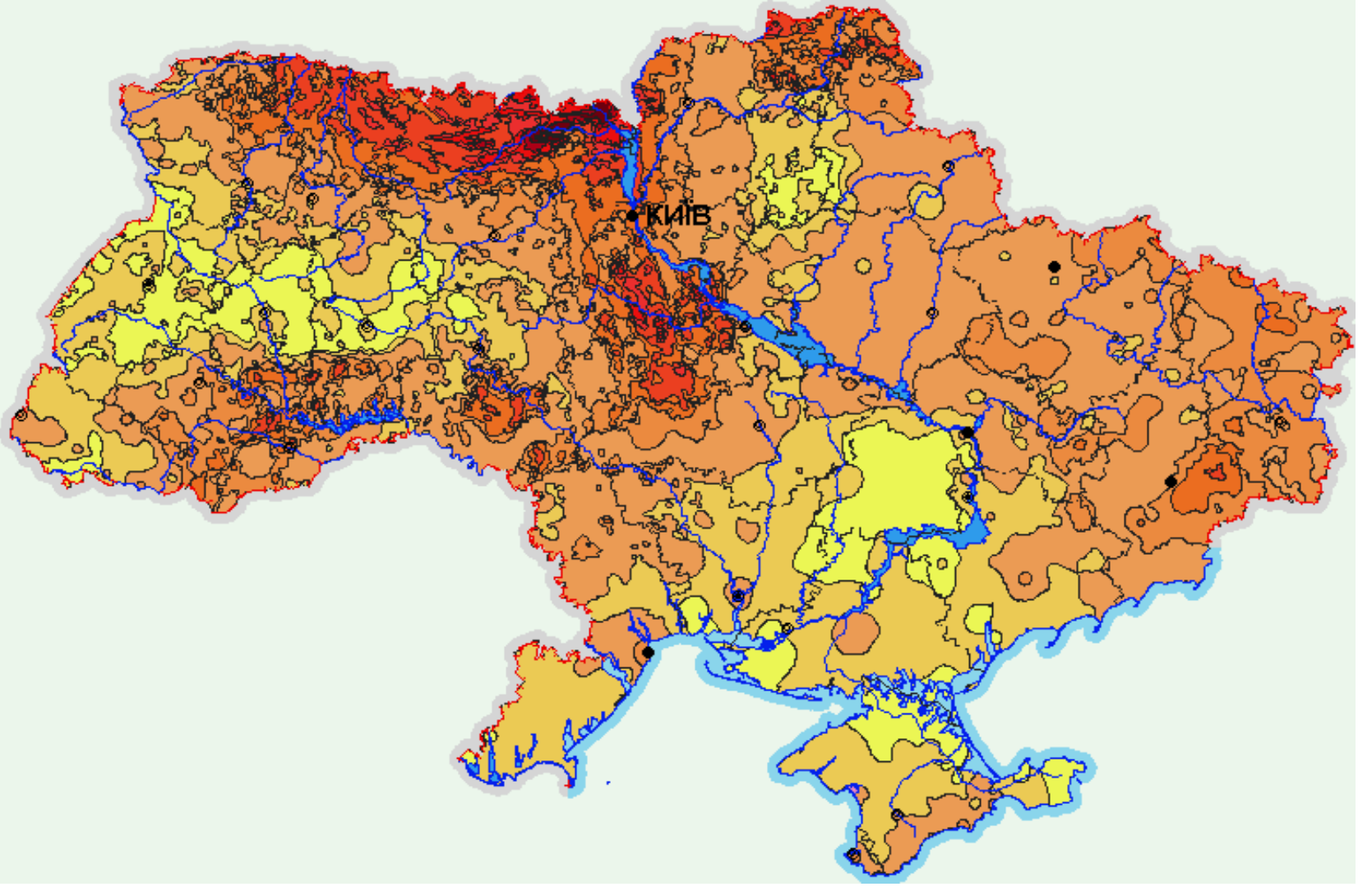


Карта загрязнения Украины цезием (137Cs) после аварии на ЧАЭС в 1986 (слева) и в 2006 (справа

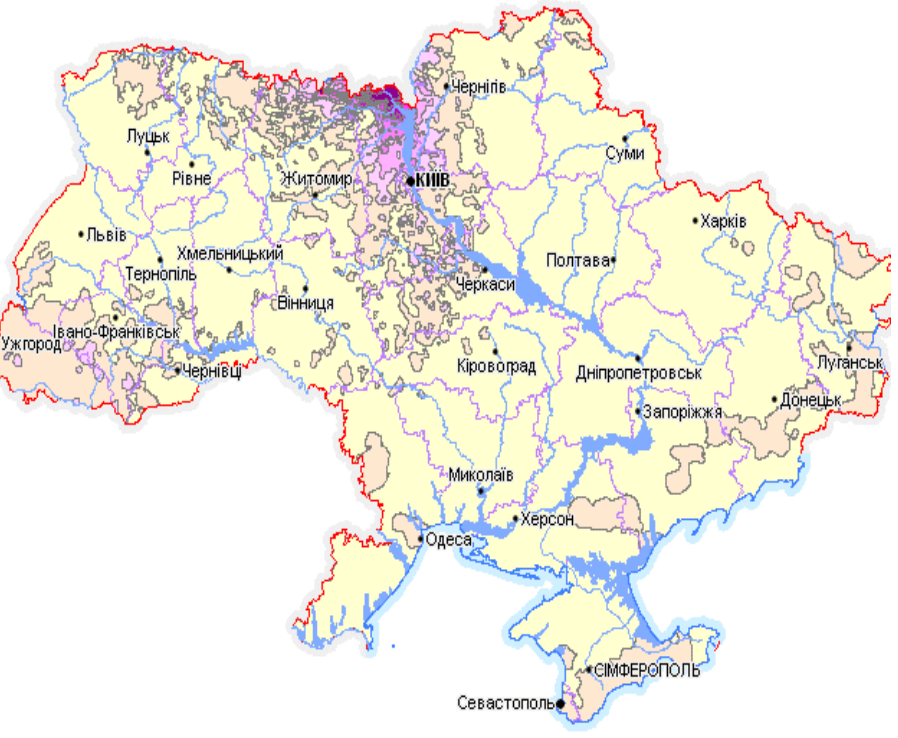




Water pollution of rivers 137Cs, 90Sr and others isotopes after Chernobyl catastrophe
Concentration of 137Cs (2-4 TBk) и 90Sr(10-20 TBk)

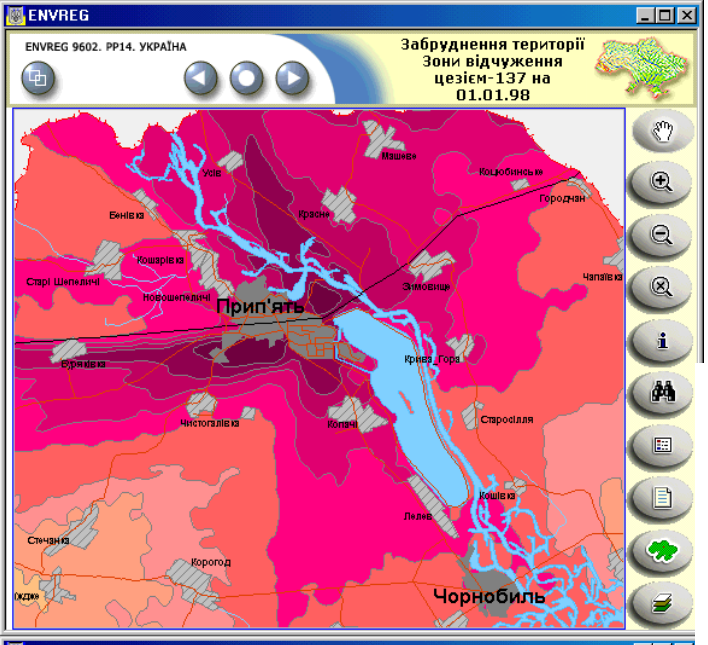


. Distribution of 241Pu and 241Am in Ukraine after accident

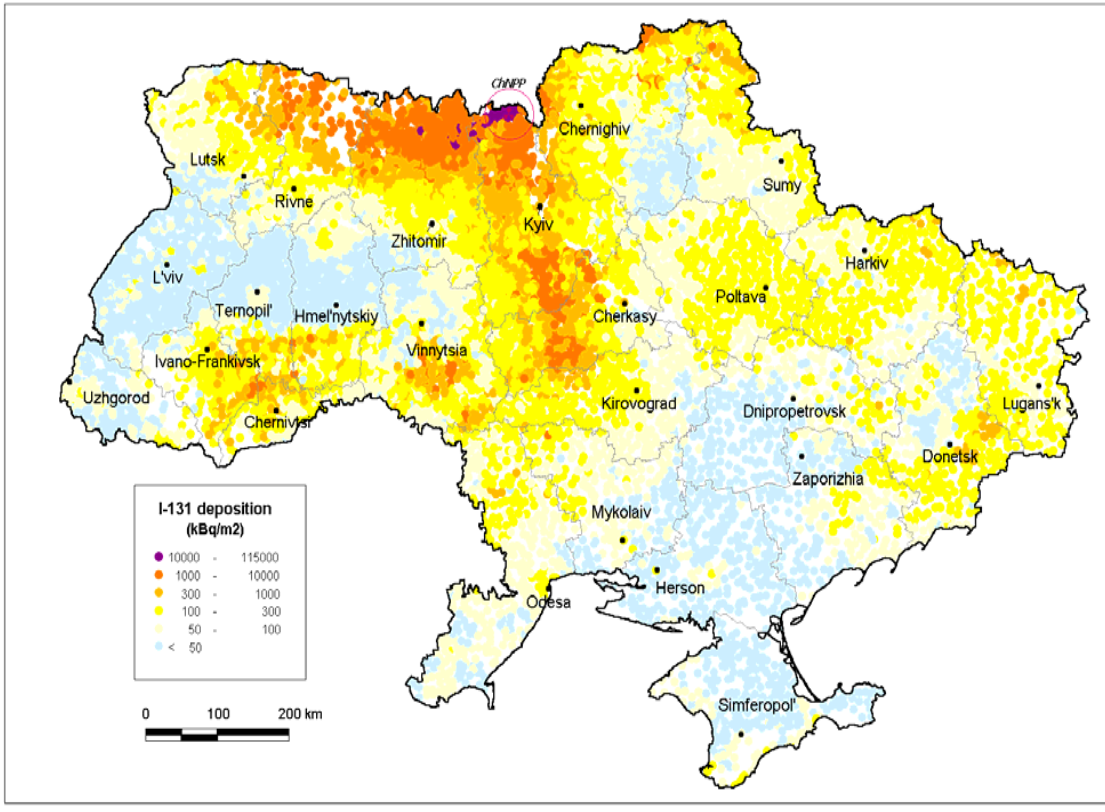


Chernobyl

caused significantly lower external, but it caused the high doses on the thyroid by the incorporation of the radioiodine and other radionuclides in first stage of accident.



Cumulative soil deposition of I-131 in Ukraine due to Chernobyl accident (26 April - 7 May 1986)



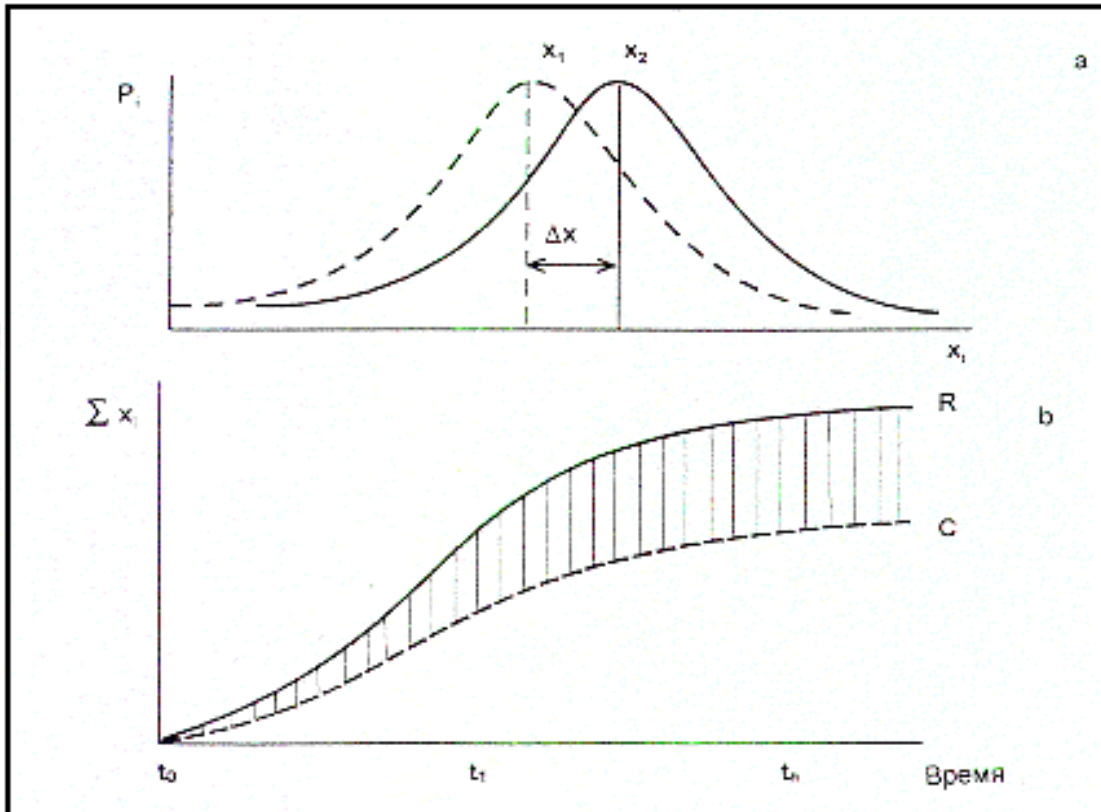
Kiev 1986 (spring)

These are the official figures but many believe the reality is much worse because these data do not include the 3 million people living in the capital of Kiev, which is less than 100 kilometres away from Chernobyl. Residents of Kiev were exposed to fallout from the accident including radioactive iodine. According to research conducted at the Nuclear Research Institute and the Geology Institute of the National Academy of Sciences of Ukraine, Kiev should have been classified as part of the third zone.

RISKS ASSESSMENT DUE TO RADIATION EXPOSURE TO POPULATION

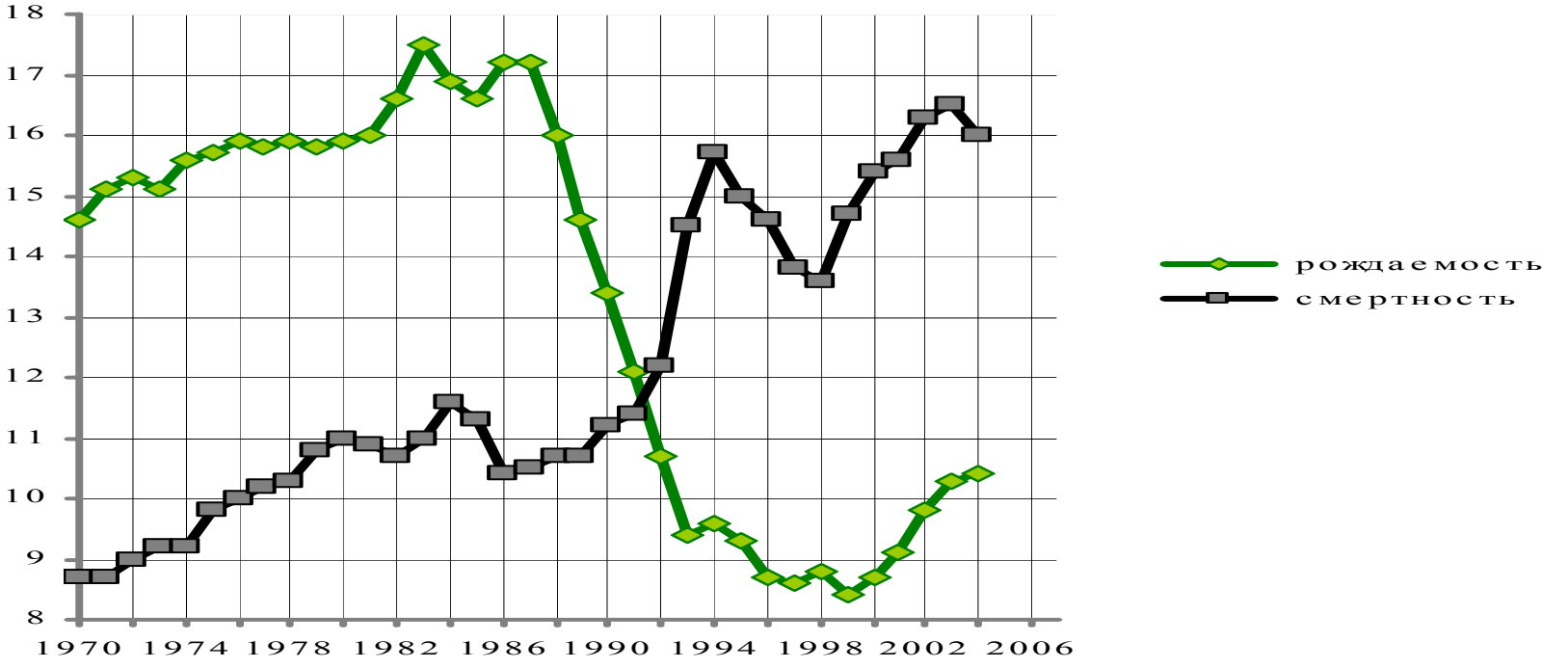
Zone category and its designation	Criteria to establish limits of the zones
1. Exclusion zone	The area from which the population was evacuated in 198 (unchanged)
2. Zone of an unconditional (obligatory) resettlement	$\sigma_{Cs} > 555$ kBq·m^{-2} or $\sigma_{Sr} \geq 111$ kBq·m^{-2} or $\sigma_{Pu} \geq 3.7$ kBq·m^{-2}, where $D_{eff}^{*} > 5$ mSv·yr^{-1}
2. The zone of a guaranteed voluntary resettlement	$185 \leq \sigma_{Cs} \leq 555$ kBq·m^{-2}, $5.5 \leq \sigma_{Sr} \leq 111$ kBq·m^{-2}, $0.37 \leq \sigma_{Pu} \leq 3.7$ kBq·m^{-2} ,where $D_{eff}^{*} > 1$ mSv·yr^{-1}
3. The zone of an enhanced radioecologic monitoring	$37 \leq \sigma_{Cs} \leq 185$ kBq·m^{-2}, $0.74 \leq \sigma_{Sr} \leq 5.5$ kBq·m^{-2}, $0.185 \leq \sigma_{Pu} \leq 0.37$ kBq·m^{-2} ,where $D_{eff}^{*} > 0.5$ mSv·yr^{-1}

Two paradigms on Chernobyl consequences estimation



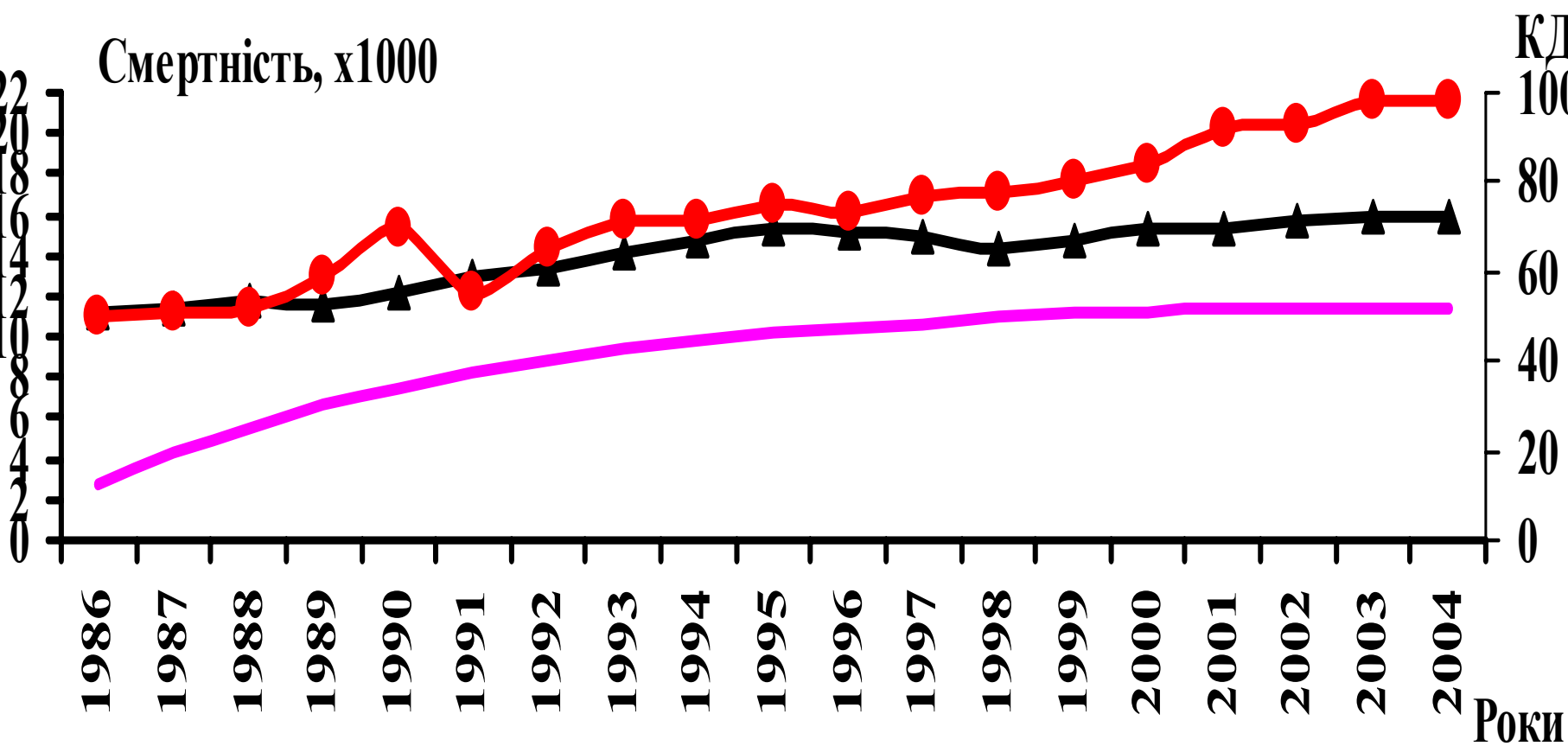
Categories of the survivors and Number On 1997-2010yy.	1997	2000	2005	2006	2008/2010
Category I – Invalids 2600 children	59582	86775	105251	106824	106 603/ 111 827
ategory 2	339666	307 982	276 072	268815	236 319/ 260 807
ncluding:					
- 1986-1987 yy. liquidators	352939	277 135	197 817	191 167	166 087 70 232
- survivors- evacuees	86726	80 847	78 255	77 647	
ategory 3	558637	549 649	537 504	533144	522 032
cluding: 3a 1988-1990 liquidators	69 620	62729	55 391	52346	44 879
3b survivors	489 017	486 720	482113	480798	477 153
tegory 4 (inhabitants on zone under ntrol)	1 169 804	1 150273	1 081 469	1 065 022	967 361/ 1 993 664
ategory D:	2530	2862	2780	2606	2262
ople who worked beyond the rritory of the exclusion Zone					
hildren survivors (including those th thyroid gland irradiation in 1986)	1 083 107	1 264 329	643 030	617 660	541 641/ 498 409
Total	3 213 326	3 361 870	2 646 106	2 594071	2 376 218/ 2 254 471

Dynamic of birth-rate and mortality of population of the most contaminated regions and according of the groups of primary count per 1000 persons (Ministry of Health of Ukraine).
Green-birth rate; black- death rate



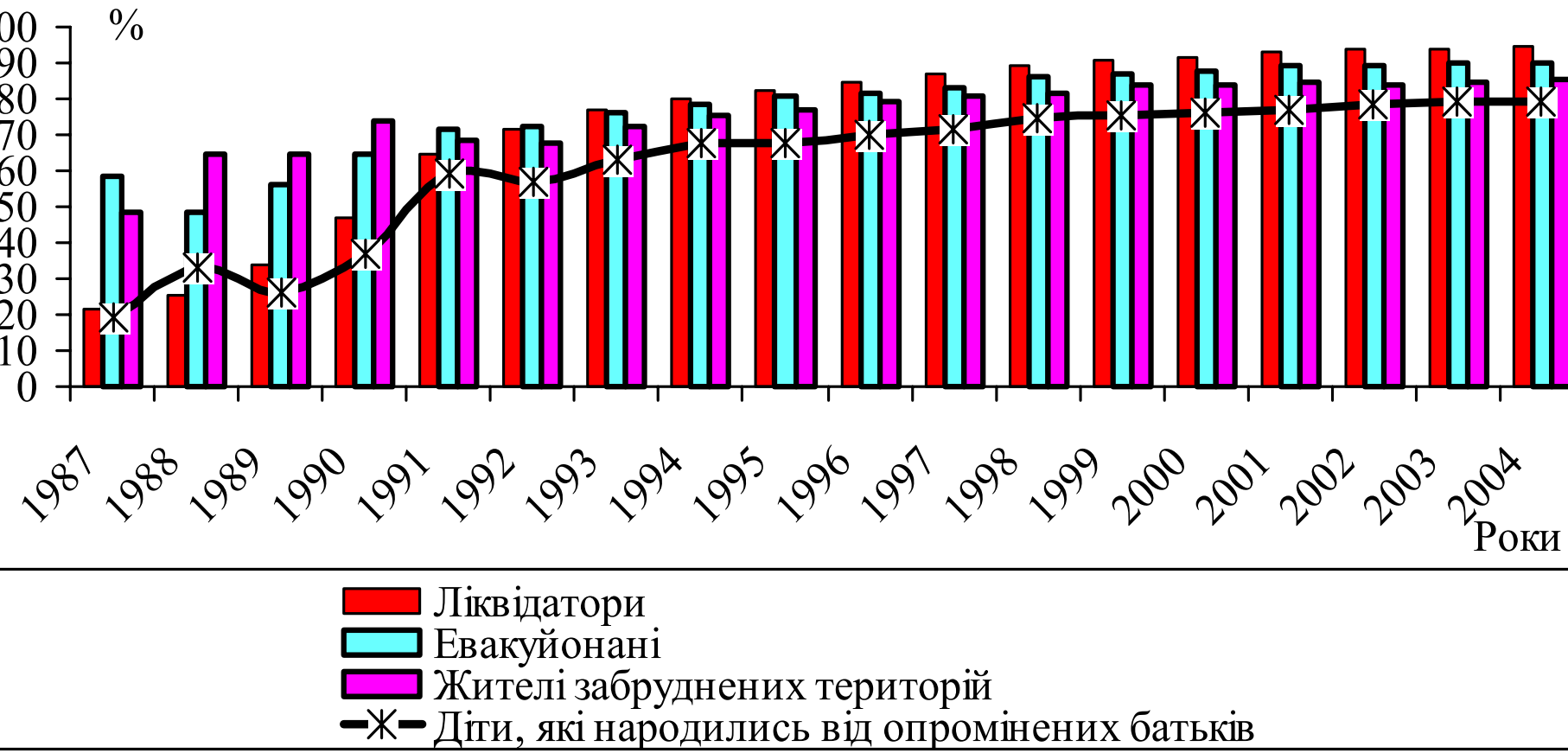
People on polluted territories in Ukraine suffer protracted medical and demographic crises in the form of increase of birth-rate, decrease of aging mortality, short-cut of life expectancy and qualitative changes of structure of death cause. The most heavily contaminated regions have a lower level of the human development index.

Death-rate in Chernobyl society and Ukraine.
Rose curve - collective dose of radiation. Red curve – Death-rate of radiated population. Black curve - death rate of Ukrainian population



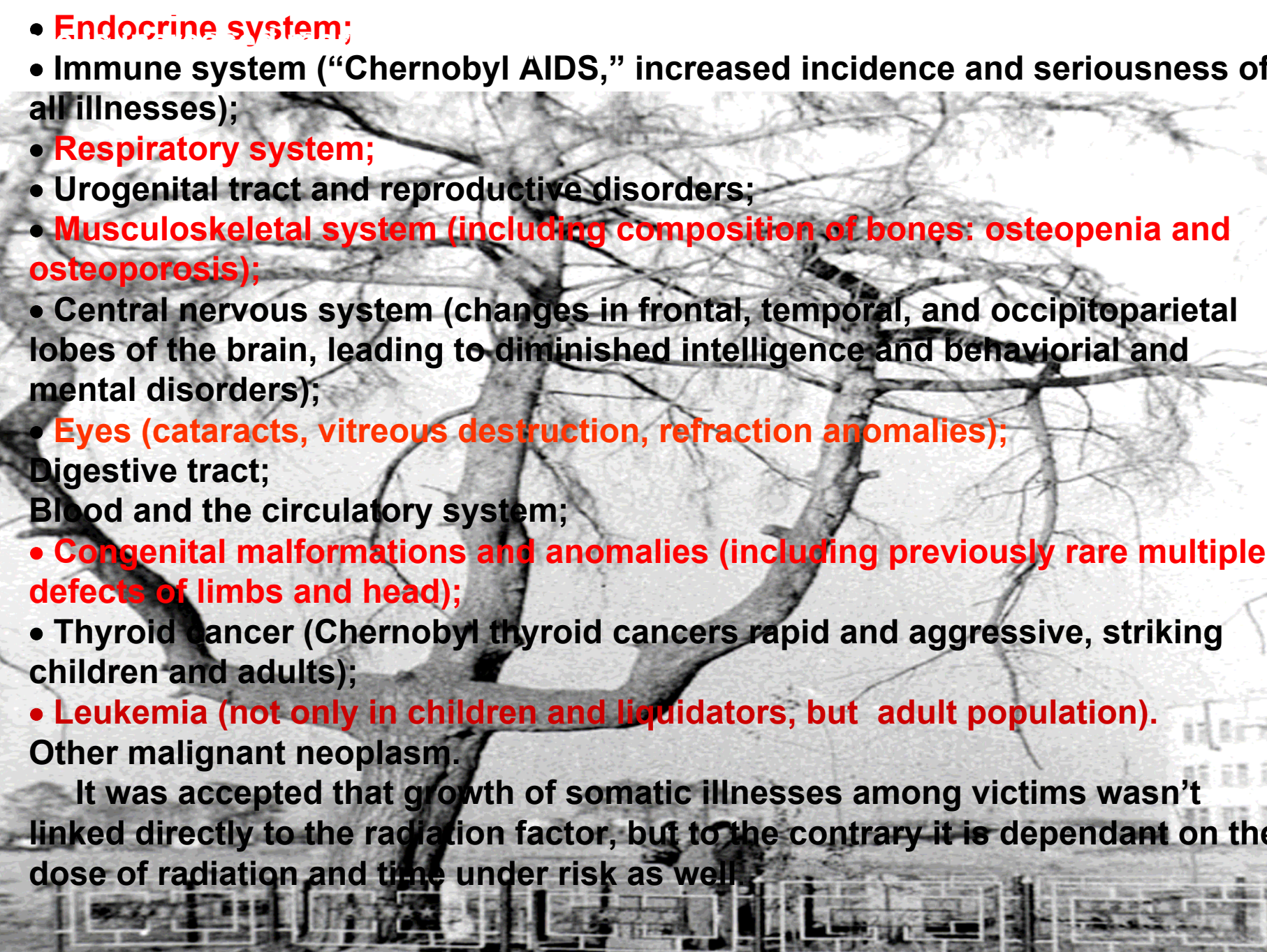
Колективна доза опромінення (КД)
Смертність постраждалого населення
Смертність населення

DINAMICS OF HEALTH of survivors (state statistics)



Red-liquidators; green- evacuees; rose- residents of contaminated regions; black –childre born by survivors parents. X-correlation with accumulate collective dose of radiation

Part of adult population which has been identified as ill by medical examination, is constantly growing and at present amounts to 94,2% for accident liquidators, 89,8% for evacuees and 84,7% for residents of radioactive contaminated territories. 79,8% of children who have been directly or indirectly affected by the



- Endocrine system;
- Immune system ("Chernobyl AIDS," increased incidence and seriousness of all illnesses);
- Respiratory system;
- Urogenital tract and reproductive disorders;
- Musculoskeletal system (including composition of bones: osteopenia and osteoporosis);
- Central nervous system (changes in frontal, temporal, and occipitoparietal lobes of the brain, leading to diminished intelligence and behaviorial and mental disorders);
- Eyes (cataracts, vitreous destruction, refraction anomalies);

Digestive tract;

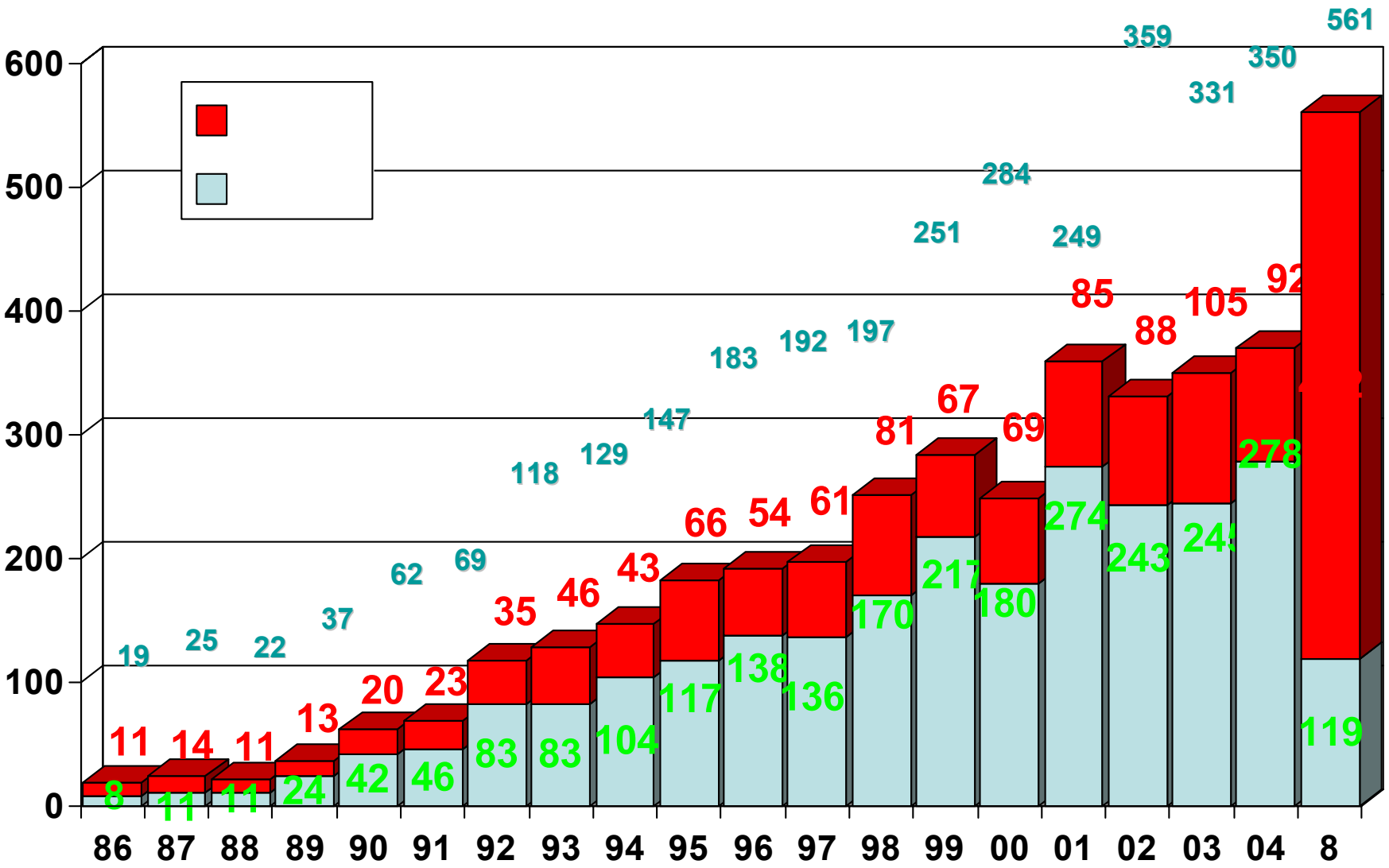
Blood and the circulatory system;

- Congenital malformations and anomalies (including previously rare multiple defects of limbs and head);
- Thyroid cancer (Chernobyl thyroid cancers rapid and aggressive, striking children and adults);
- Leukemia (not only in children and liquidators, but adult population).

Other malignant neoplasm.

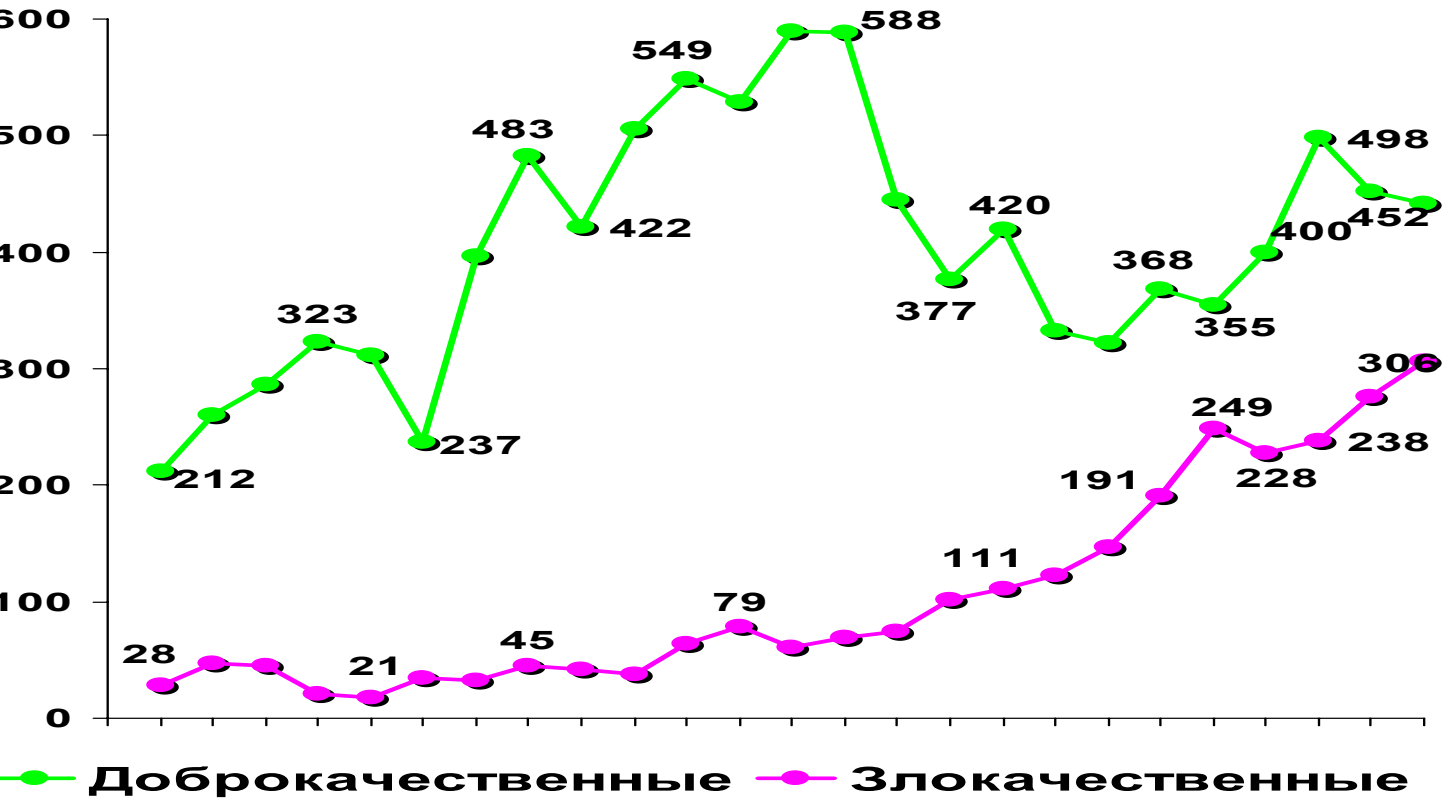
It was accepted that growth of somatic illnesses among victims wasn't linked directly to the radiation factor, but to the contrary it is dependant on the dose of radiation and time under risk as well.

Thyroid cancer in children and adolescents of Ukraine (0-18 years)



Thyroid operated cancer in Children born before accident (black), after accident (red) and children born after accident (yellow). I. Komissarenko, 2006

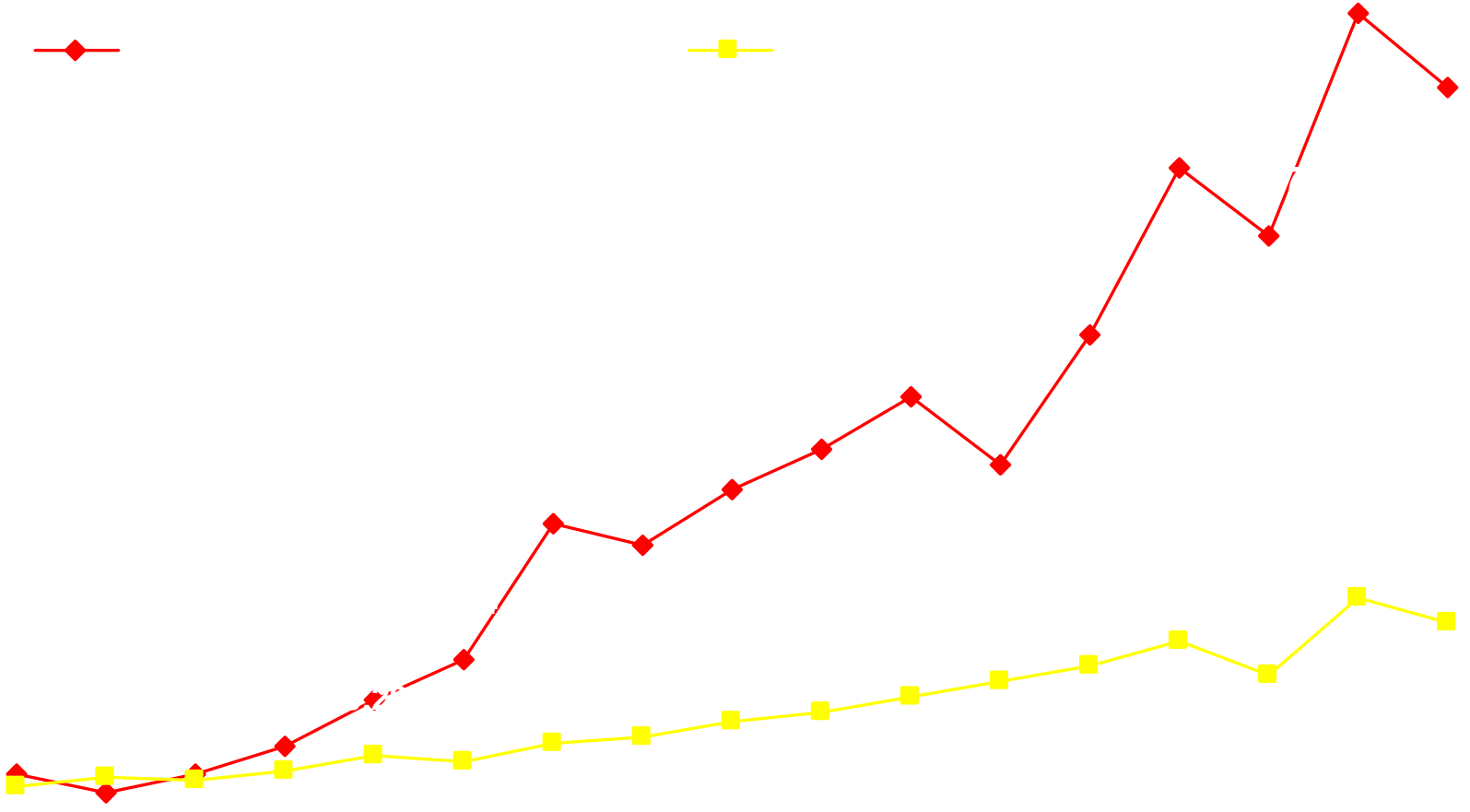
DINAMICS OF THYROID TUMOURS IN ADULTS (non-malignant-green, malignant- red)



очинаючи з 1990 року, зросла захворюваність на рак щитовидної алози до 60 випадків на рік, при 12 випадках у дочорнобильський еріод.

Це є більше, ніж у 21 раз за дочорнобильський період ахворюваності.

DINAMICS OF THYROID CANCER ON CONTAMINATED REGIONS (red curve) AND IN UKRAINE (yellow curve)



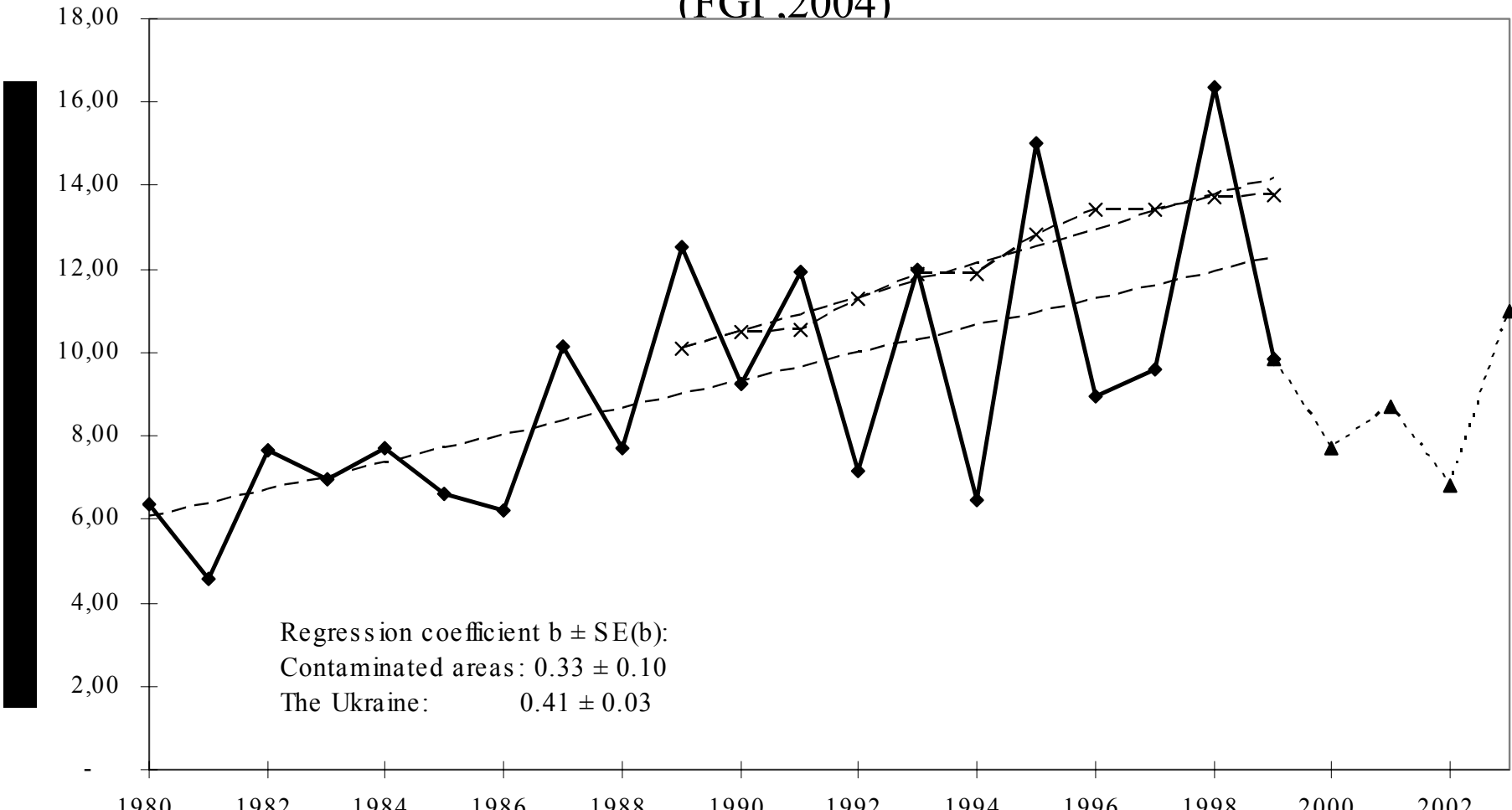
OTHERS MALIGNANT TUMOURS MORBIDITY

Incidence rates of main forms of solid cancers in districts most heavi contaminated with radionuclides (2004, FGI)

Tumour site (code ICD-9)	Sex	Period (age standardised rate ± standard error)		Rate ratio $_{2/1}$ (95% CI)
		1980-1990 (1)	1991-1999 (2)	
All solid cancers (140-203)	Males+females	160.83 ± 2.12	186.71 ± 3.17	1.12 - 1.22
Buccal cavity, pharynx (140-149)	Males+females	10.48 ± 0.54	12.08 ± 0.77	0.98 - 1.36
Digestive system (150-159)	Males+females	47.80 ± 1.12	51.14 ± 1.55	0.99 - 1.15
Respiratory system (160-165)	Males+females	25.63 ± 0.83	27.21 ± 1.12	0.96 - 1.18
Skin (172, 173)	Males+females	15.49 ± 0.63	14.71 ± 0.80	0.83 - 1.08
Breast (174)	Females	16.82 ± 0.97	25.31 ± 1.67	1.25 - 1.81
Female genital organs (180-184)	Females	20.83 ± 1.06	20.21 ± 1.59	0.81 - 1.16
Prostate (185)	Males	7.59 ± 0.70	10.90 ± 0.99	1.11 - 1.86
Bladder (188)	Males	8.68 ± 0.76	9.35 ± 0.95	0.83 - 1.40
Brain (191)	Males+females	3.40 ± 0.36	4.11 ± 0.63	0.83 - 1.77
Thyroid (193)	Males+females	1.70 ± 0.24	6.69 ± 0.76	2.56 - 6.07

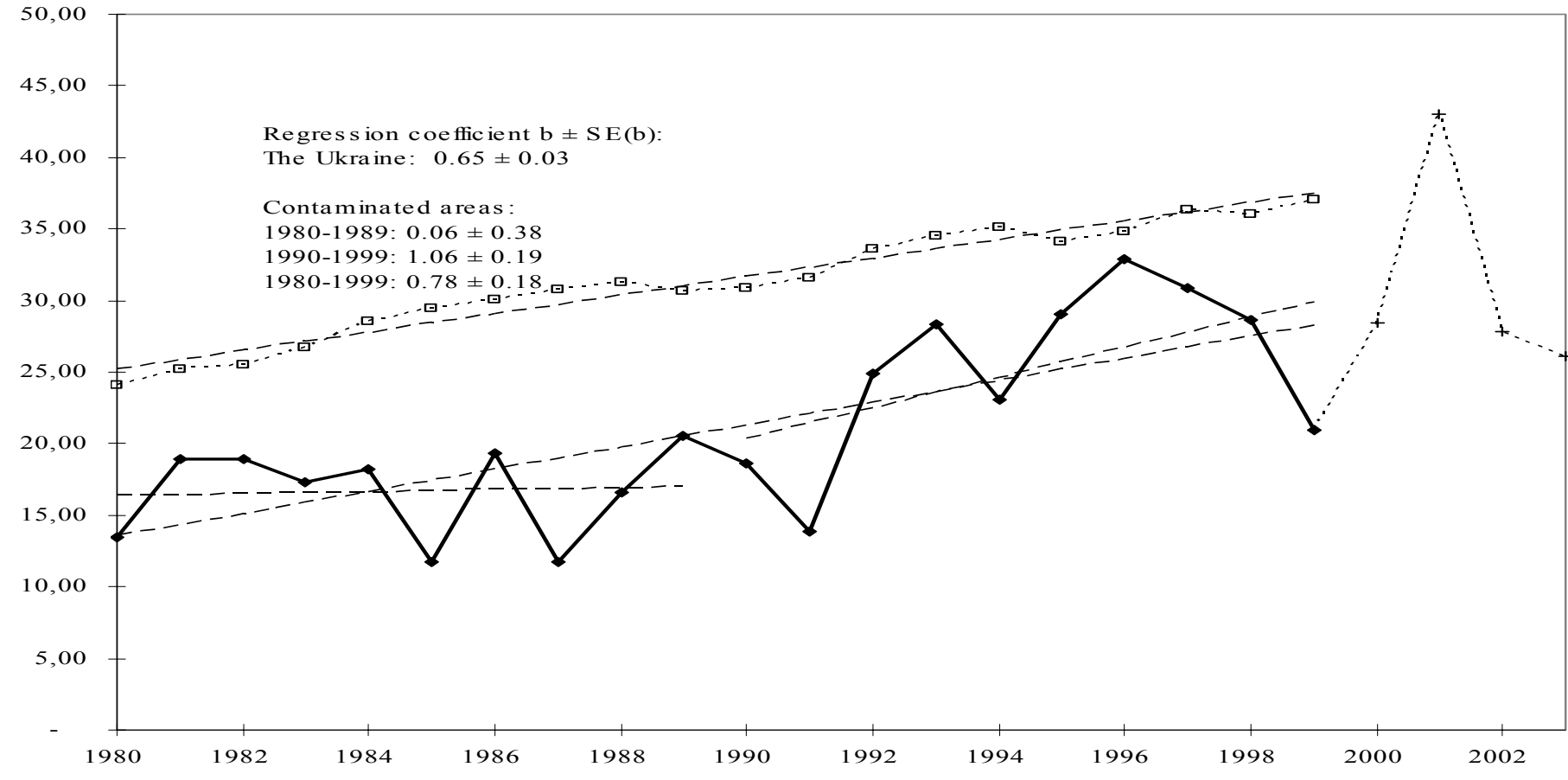
Prostate cancer (ICD-9 185) incidence rates in the districts most heavily contaminated with radionuclides.

According to international evaluation, prostate cancer does not belong to radiosensitive form of cancer. Study prostate cancer incidence rate grew up rapidly in 1987 and since then was much higher than in pre-accidental period. (FGI ,2004)

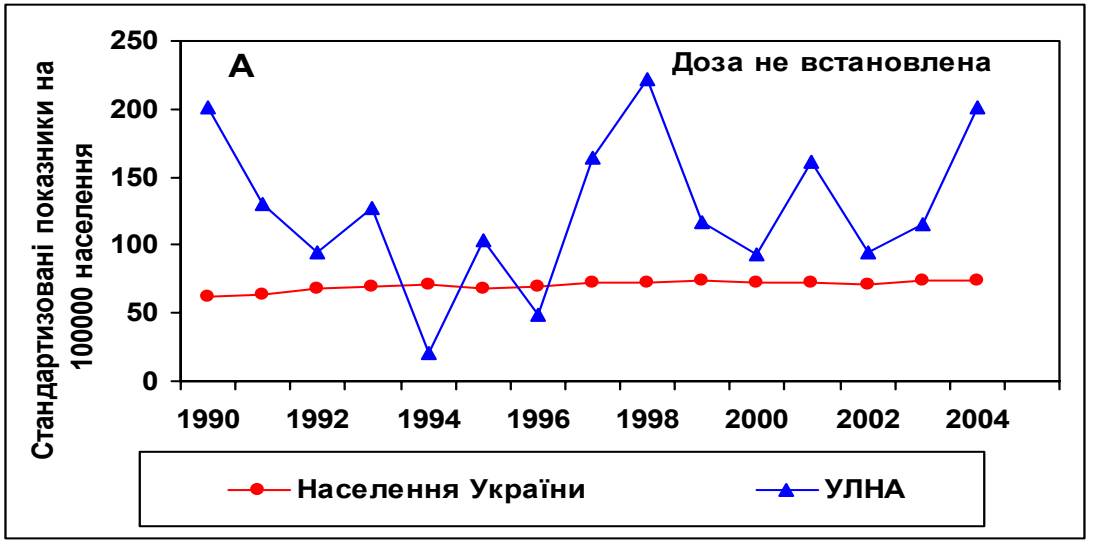


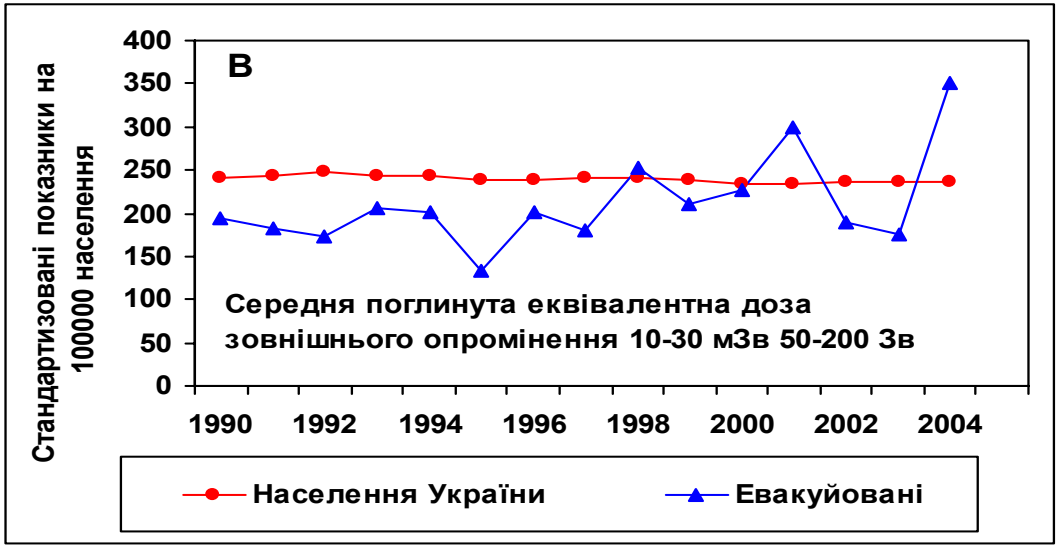
reast cancer (ICD-9 174) incidence rates in the districts most heavily contaminated with adionuclides.

lose attention should be drawn to breast cancer. After six or seven years of a stable level of breast ancer incidence rate (with small fluctuations) a sharp increase has been observed since 1992. This rm of cancer belongs to radiosensitive form of malignancies and needs close attention in the future.



Other malignant tumor morbidity: all tumors in liquidators and evacuees people





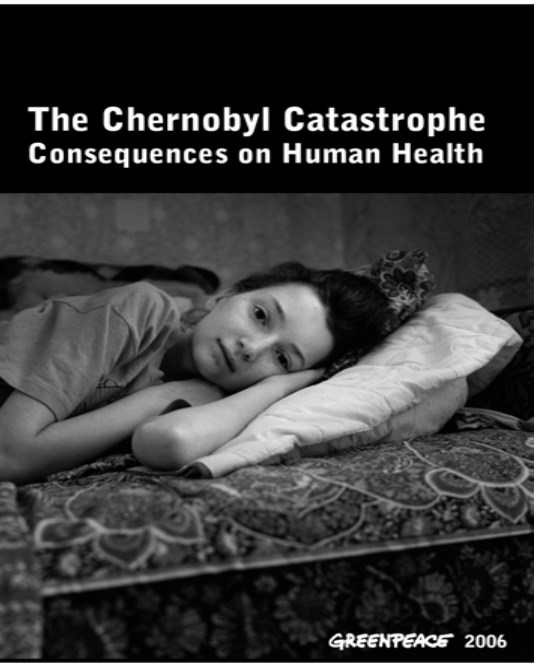
Because of different latency period of radiogenic forms of cancer there have to be drawn close attention to cancer of **breast, lung, esophagus, stomach, bowl, ovary, lymphomas (multiple myeloma)** etc.

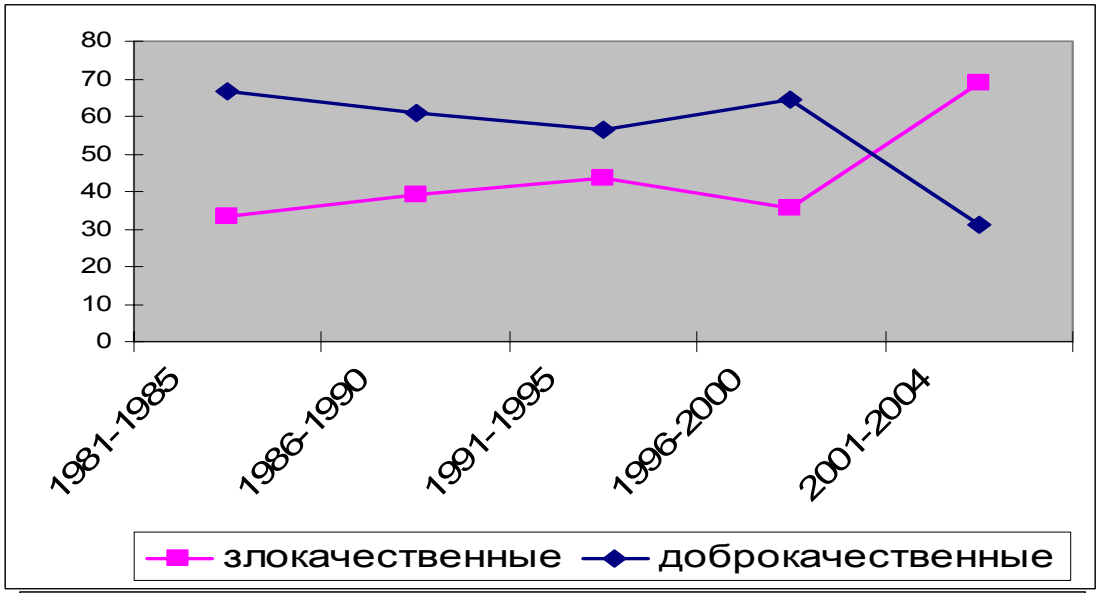
Special attention should be drawn to groups of population irradiated at the **beginning of life (*in utero*, young age 0-9, 10-19).**

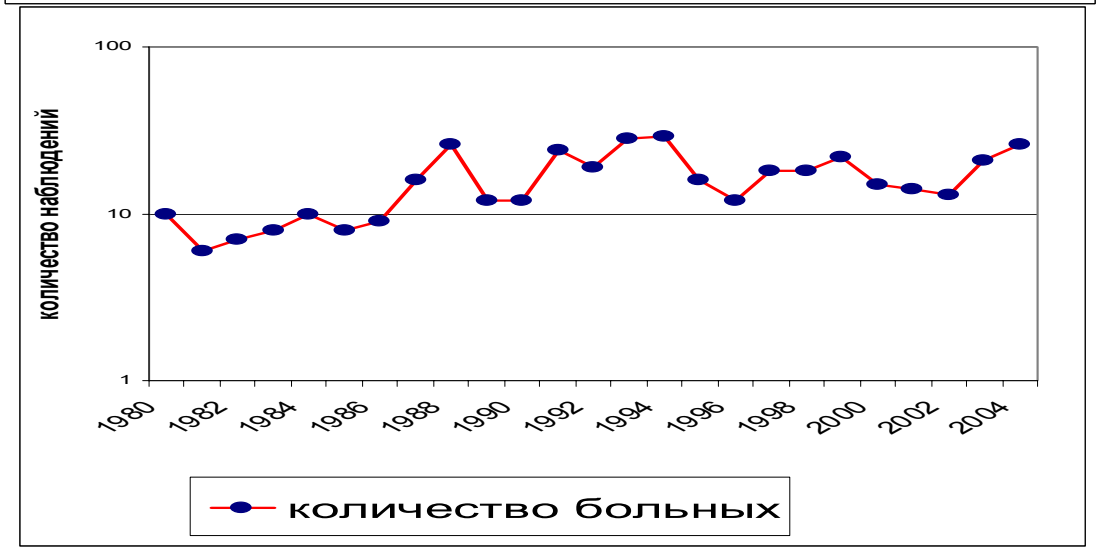
AVERAGE INDEXES OF TOTAL CHILDREN DISABILITY IN AGE OF 14–15 IN UKRAINIAN PROVINCES WITH POPULATION SURVIVED AFTER THE CHERNOBYL ACCIDENT FOR 2001 (PER 10,000 CHILDREN POPULATION OF 14–15 YEARS OLD)

las of ise ses	Names of class diseases	An average index for examined provinces	An average index for other provinces of Ukraine	Percent difference between compared indexes
.0	**Neoplasm**	7.6	5.5	**+38.2**
.0	Diseases of blood and hemopoietic organs	2.7	2.5	+8.0
.0	Diseases of endocrine system	12.2	11.2	+8.9
.0	Mental and behavioral disorders	37.5	41.7	-10.1
.0	Diseases of nervous system	44.4	41.3	+7.5
.0	Diseases of respiration organs	15.0	12.9	+16.3
.0	**Diseases of digestion organs**	5.4	3.1	+**74.2**
.0	Diseases of urogenital system	5.0	4.6	+8.7
.0	**Congenital anomalies**	35.9	26.7	**+34.0**

INDICIES OF NEUROONCOLOGIC MORBIDITY DYNAMICS AMONG YANGER CHILDREN IN UKRAINE (Yu. Orlov)







he pre-Chernobyl period (1981-1985) – 49 cases.
he post - Chernobyl period -
86-1990 - 75 cases (1,9 -fold increase);
91-1995- 116 cases (2,9- fold increase);
96-2000- 85 cases (2,1 – fold increase);
01-2004- 94 cases (2,3 – fold increase).
r children under one year old – 6,2 –fold
owth. To account a decrease in birth rate
d natural reduction of absolute quantity
children, the growth of average index 5,8
ld more is very significant.
alignant tumour constitute
3% of all central nervous system neoplasm in

Leukemia

The preliminary analysis of infant leukaemia incidence in Kyiv city after Chernobyl within 1986-1997 period showed also an increase in acute myeloid leukaemia and B-cell acute lymphoblast leukaemia *[Gluzman et al., 1999].*

At present leukaemia's rank first in the patterns of morbidity and mortality due to malignancies in children of Ukraine aged 0-14 years *[Fedorenko et al. In: Bull National Cancer Register of Ukraine 2004].*

The stable tendency towards increased rates of acute lymphoid leukaemia's has been noticed both in Ukraine as a whole and in particular regions being the most contaminated with radionuclides *[Noschenko A. and al. 2001; 2002; Pushkar LO and Klimnyuk GI, 2005*].

Moreover, recently several limited studies of the infant leukaemia's after Chernobyl have been performed also in several European countries with particular emphasis on the children believed as having been exposed in utero (judging by the dates of their birth) *[Petridou, et al., 1996; Michaelis et al., 1997; Noschenko A. and al. 2001; 2002; D. Davidescu and all. 2004, Davis S. and al.2005].*

Special attention should be drawn to groups which were in early age at the moment of Chernobyl accident (exposed in utero, 0-9, 10-19 years old).

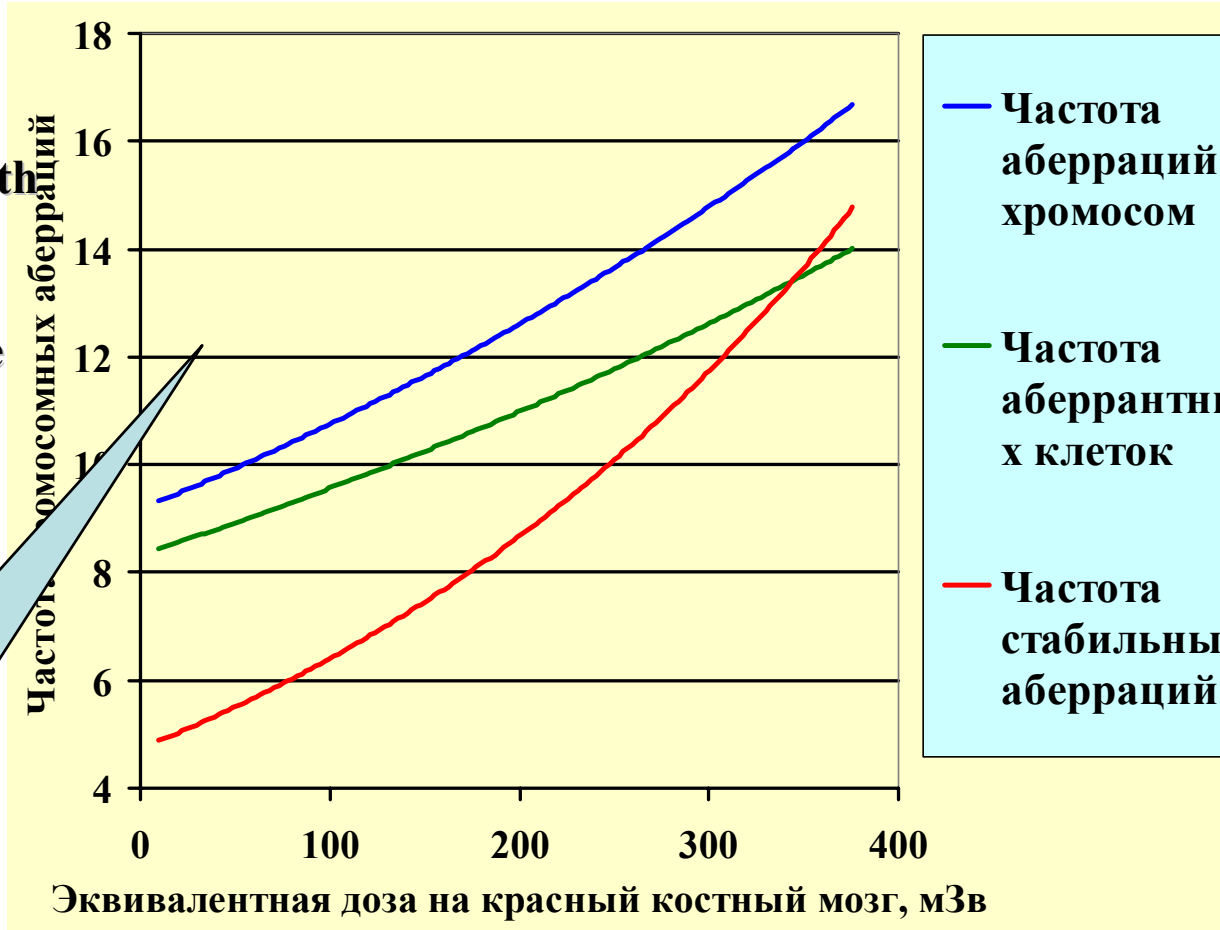
(*Resolution of Int. conf. 29 May-June 3, Kiev 2006).*

GENETIC DAMAGE

- **According to state statistics, the frequency of congenital malformation in the affected regions IS**
- **5-fold INCREASE (2005). At the same time**
- IN ALL THE GROUPS MONITORED DURING POSTACCIDENT PERIOD THE RATE OF CHROMOSOME ABERRATIONS IN PERIFERAL BLOOD LYMPHOCYTES SIGNIFICANTLY EXEEDED PRE-ACCIDENT INDICES CHARACTERISTIC FOR SPONTANEOUS CHROMOSOME MUTAGENESIS.

Heritable effects in children with exposure in utero (Stepanova E.I. an all.2006

he cytogenetic examination now the higher of aberrant ells and interdependence with quivalent dose of red bone norrow:
requency of the chromosome berrations per 100 cells;



The doses of red bone morrow 10—376 mSv

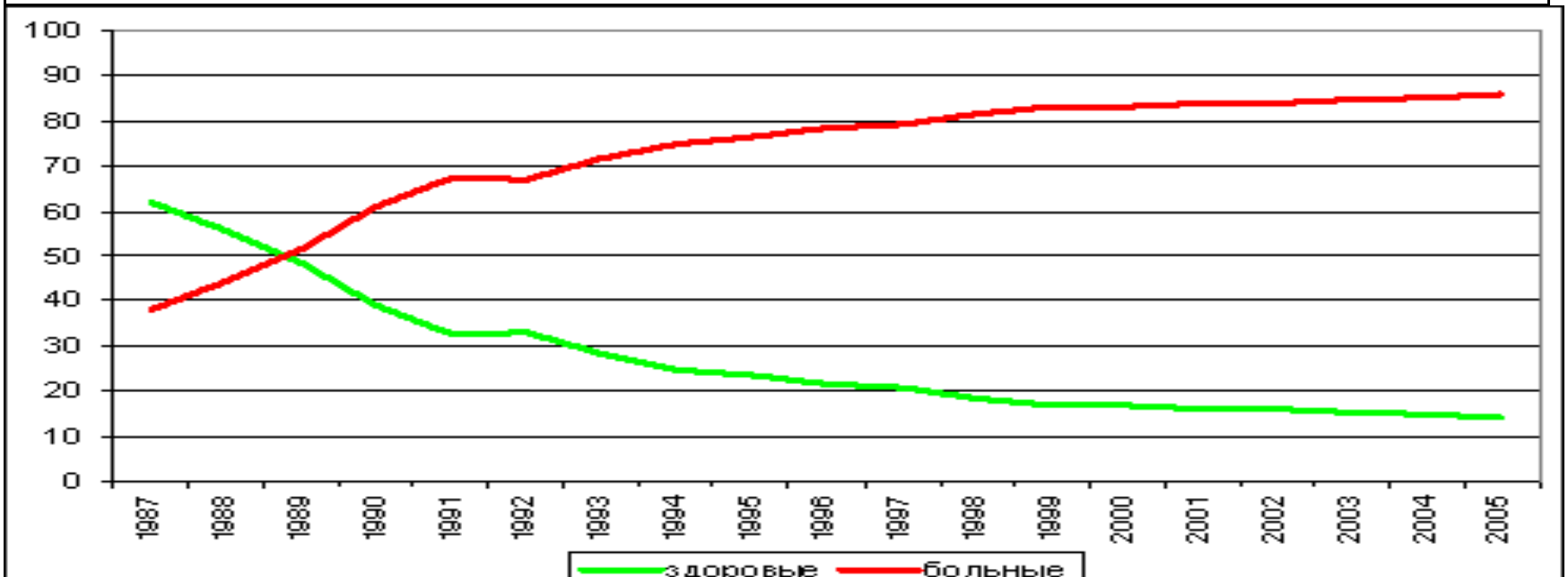
An increased frequency rate of chromosome aberrations was found in children who had been exposed to combined ^{131}I and ^{137}Cs radiation. The influence of thyroid pathology on induction of chromosome non-stability in human somatic sells was demonstrated.

A deferred cytogenetic effects has been found in successive cell generations in the progeny of irradiated parents proving for real transmission of chromosome non- stability.

(National Report of Ukraine, 2006)

Generalized Non-Cancer Illnesses


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Ликвидаторы
Эвакуированные взрослые и подростки
Взрослые и подростки, проживающие на территориях радиолопического контроля
Дети до 14 лет, проживающие на территориях радиолопического контроля
здоровые
больные


100
90
80
70
60
50
40
30
20
10
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
здоровые
больные

Accident clean-up workers ('liquidators'), including military and the civilian personnel drafted to carry out clean-up activities and construct the protective cover for the reactor.

More than **850 000 (liquidators) people** from all regions of the former USSR during 1986-1990 were involved in the clean-up works in the 30-kilometer exclusion zone. **600 000 out of them were the military**. They were fighting the radioactive fire, building the sarcophagus over the 4-th destructed block of Chernobyl NPP, deactivating the production platform, burying radioactive materials and equipment - they were the first people who were overcoming the consequences immediately after the accident. Some of the activities on overcoming the Chernobyl accident consequences are still in process. These activities have carried out under extremely hard conditions so that military rules were followed.

For today we don't know accuracy how many liquidators were! What why for therefore it is hard to estimate the real those health risks

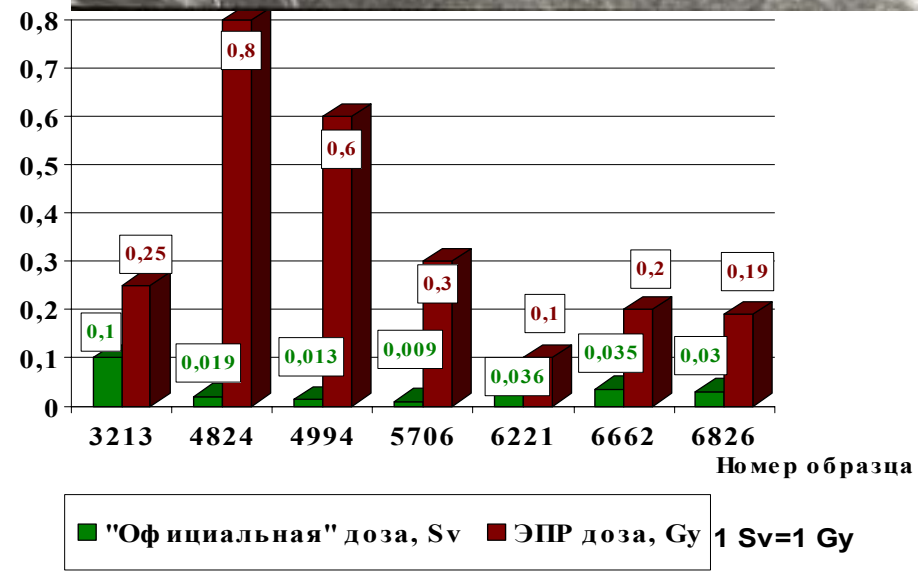
LIQUIDATORS OF CATASTROPHE

Countries	2006
UKRAINE	**308 856**
Belarus	**115 000**
Russian Federation	189 150
Armenia	2200
Azerbaijan	6000
Georgia	2000
Kazakhstan	30000
Kyrgyzstan	1810
Latvia	5020
Lithuania	6600
Moldova	4500
Uzbekistan	10000
Tajikistan	2150
Turkmenistan	2000
Estonia	3000
Israel	1056
USA	4000 ?

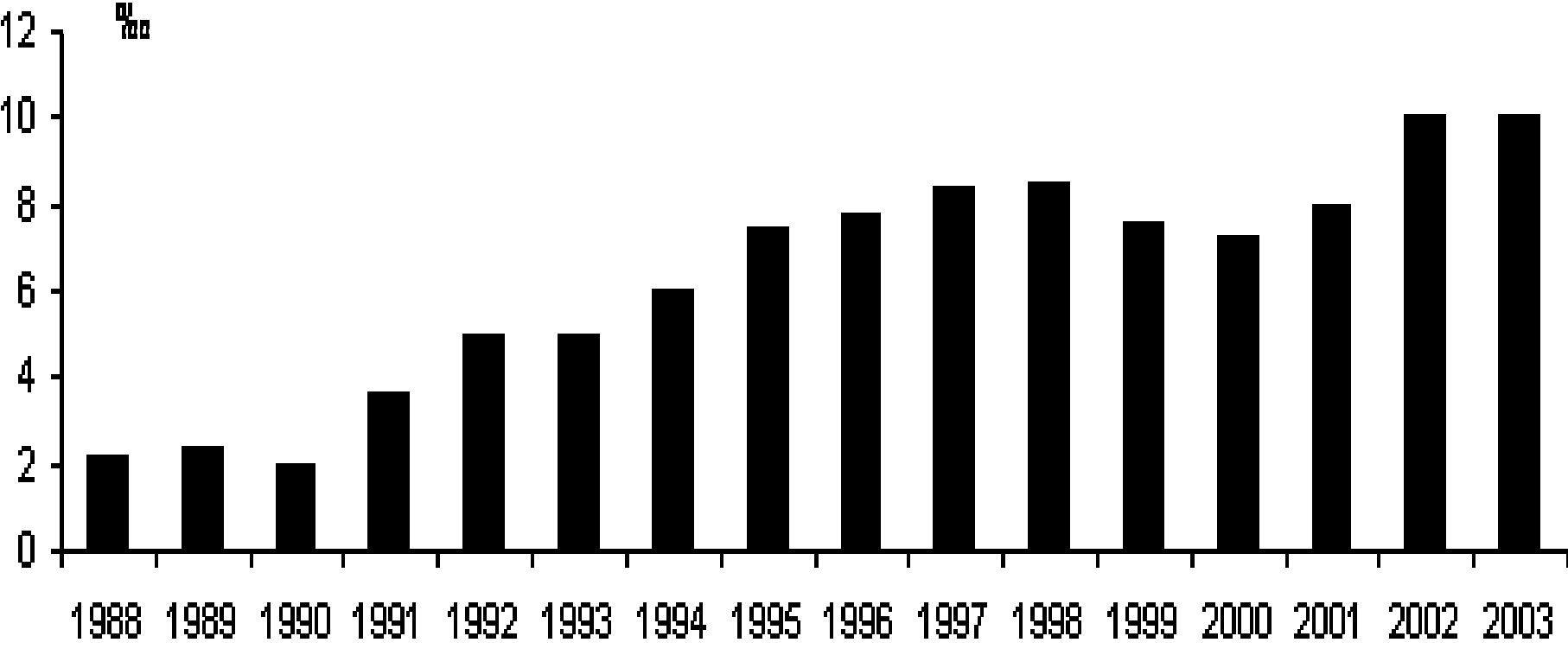
Liquidators DOSIMETRY

- construction workers who built the tunnels and shelter around destroyed reactor and in the later period on the roof of the 3rd unit of the Chernobyl NPP.
- Doses of radiation to which liquidators and emergency clean-up workers were subjected are in the average range and low intensity limits of 50-200 mSv. But due to the absence of effective dosimetric control and because of complicated and uninvestigated radiation conditions many liquidators received doses of over 1Gy during the 1.5 months following nuclear accident. This would include many people, especially nuclear power plant personnel, firemen, military people, miners,

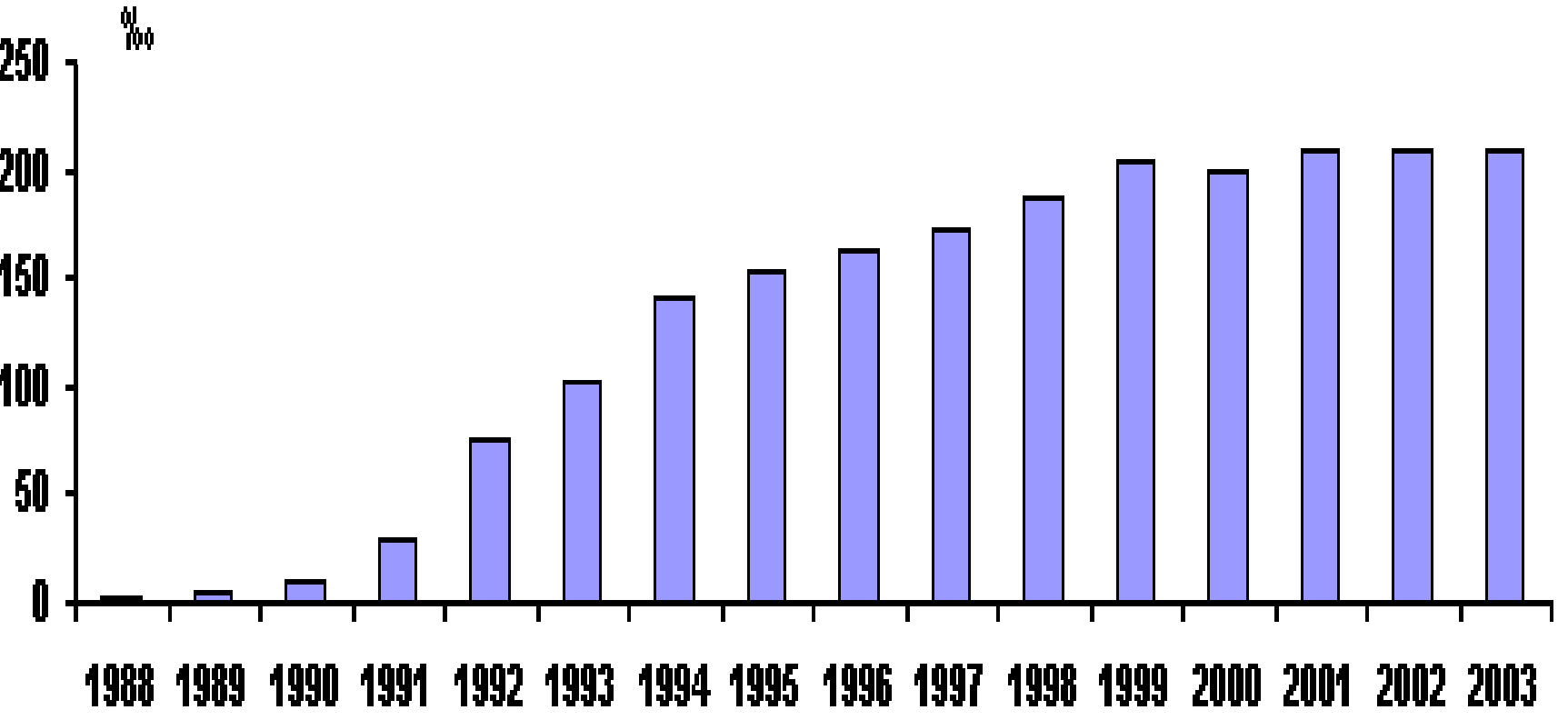
We can state that among those groups there are people in whom the ARS was never clinically established. As a whole, the information about the dosimetric state of liquidators is incomplete (only 50% of this information about received doses of radiation is available) and unclear (since it is unknown how accurate the available records about these doses may be). This data in its current state cannot be used to assess radiation risks and to analyze real radiation medical effects of the explosion and needs revision.



Dynamics of lethality from non-tumour morbidity in 1986-1987 Ukrainian liquidators during 1988-2003

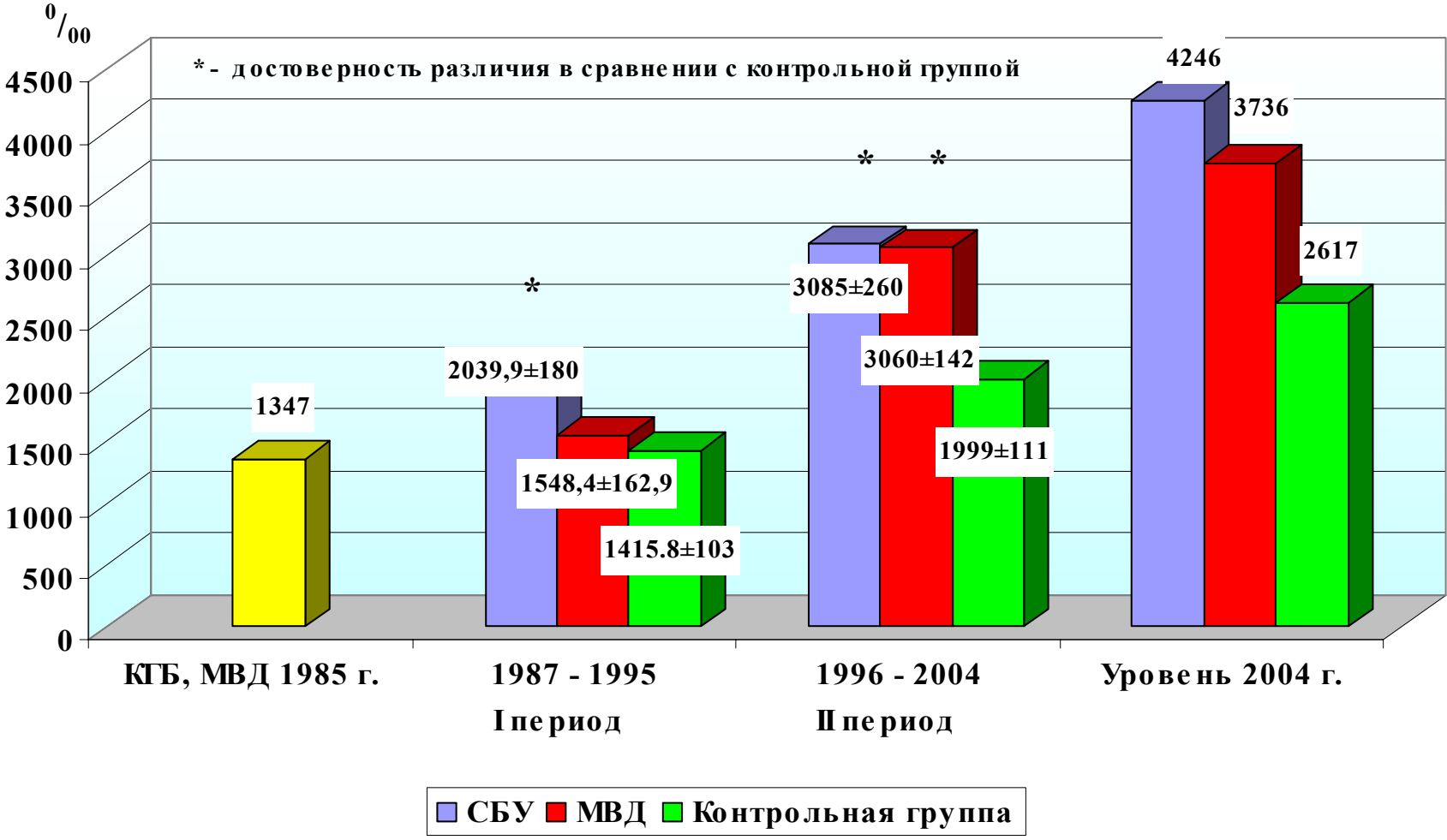


Dynamics of invalidity/incapacity connected with non-tumor morbidityin Ukrainian liquidators in 1986-1987 during 1988-2003

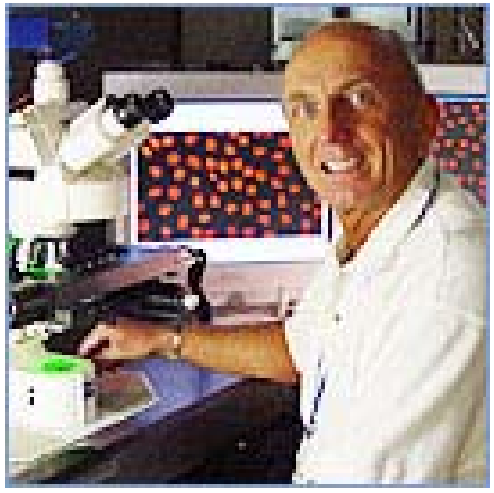


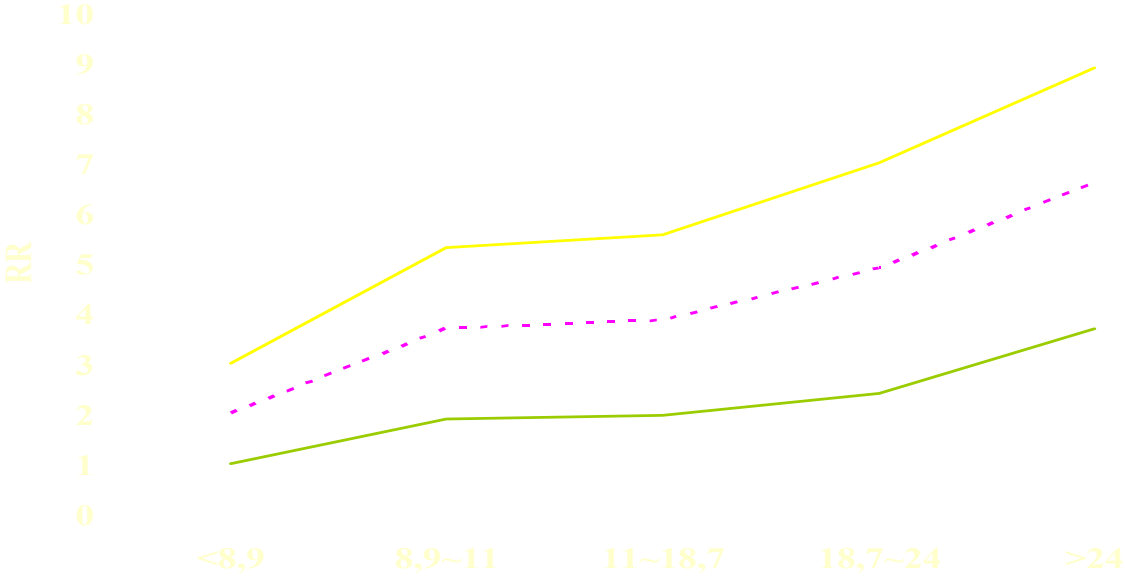
LIQUIDATORS MORBIDITY

Динамика распространенности заболеваний у ЛПА на ЧАЭС СБ и МВД Украины в послеаварийном периоде (в $^{0}/_{00}$)



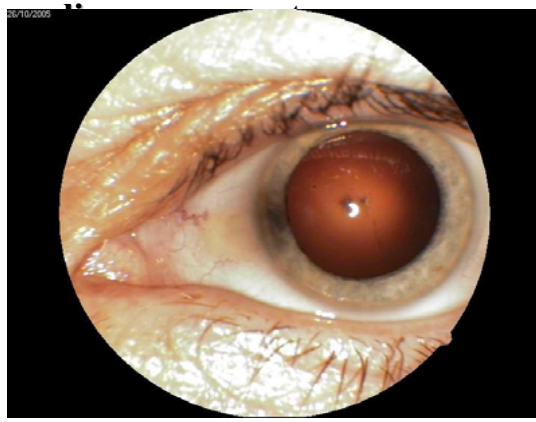
Professional Cataract





Dose of radiation of lens liquidators

In fact, it is observed that the appearance of radiation-induced cataracts among all groups of survivors, and especially the liquidators, is increasing. Much lower threshold of irradiation doses is set for cataract development compared to

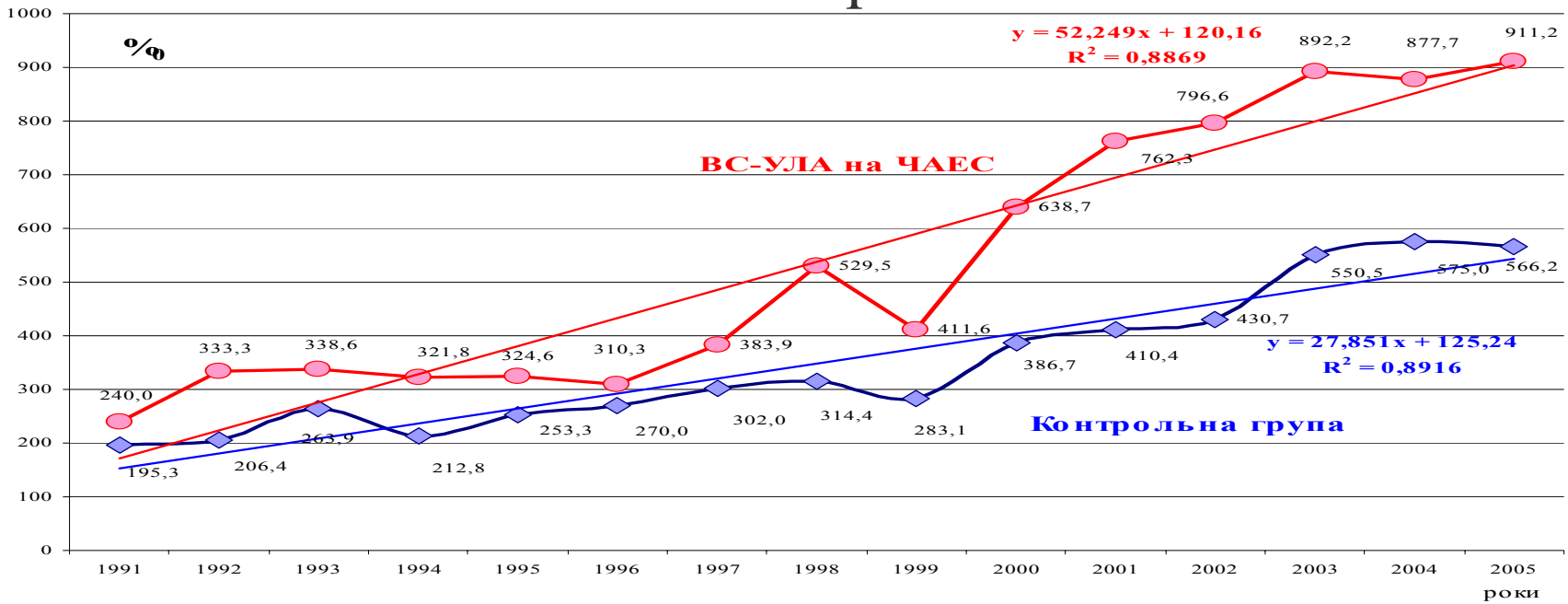


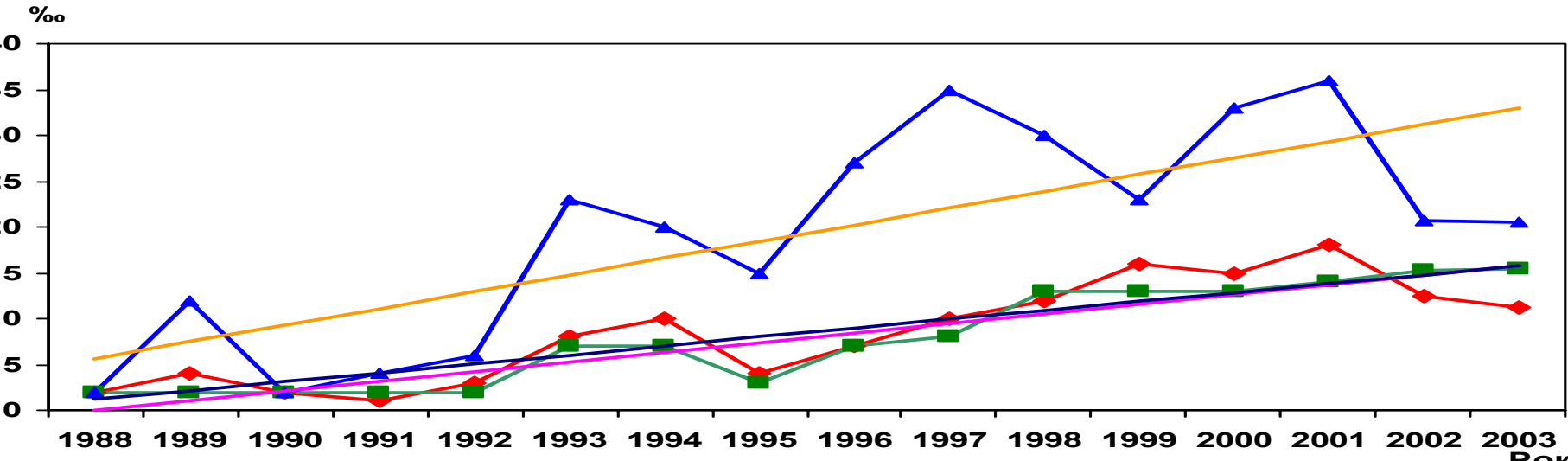
Radiation dose and risk increased at low dose.

The risk of cataract development in liquidators

Dose cGy and age (< 40, 40-55, >55 old)

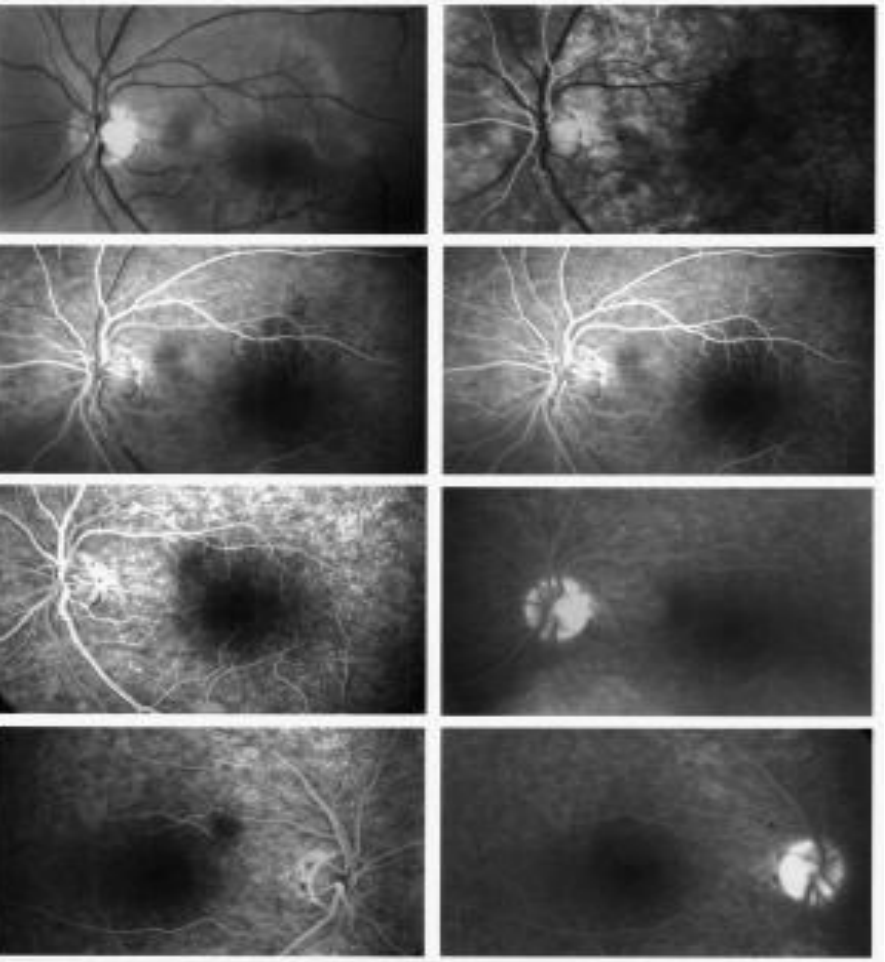
Dynamics of Cardiovascular and cerebrovascular diseases in liquidators





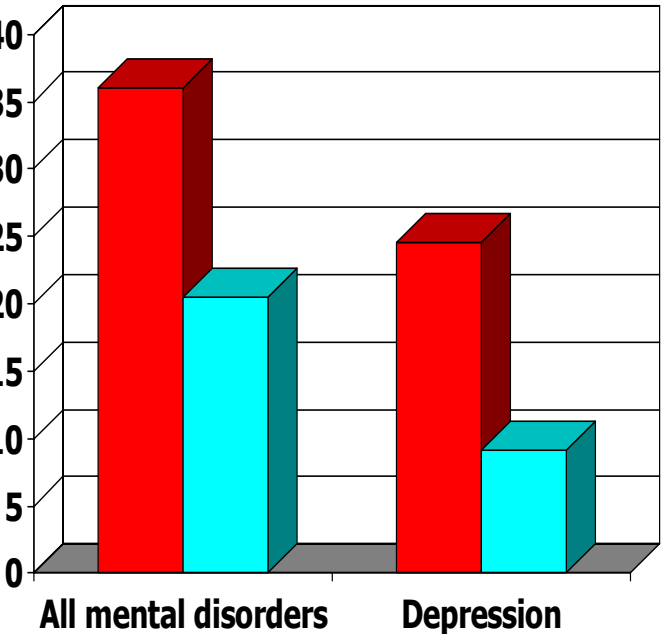
CEREBROVASCULAR DISEASES - ENCEPHALOPATHY SYNDROM

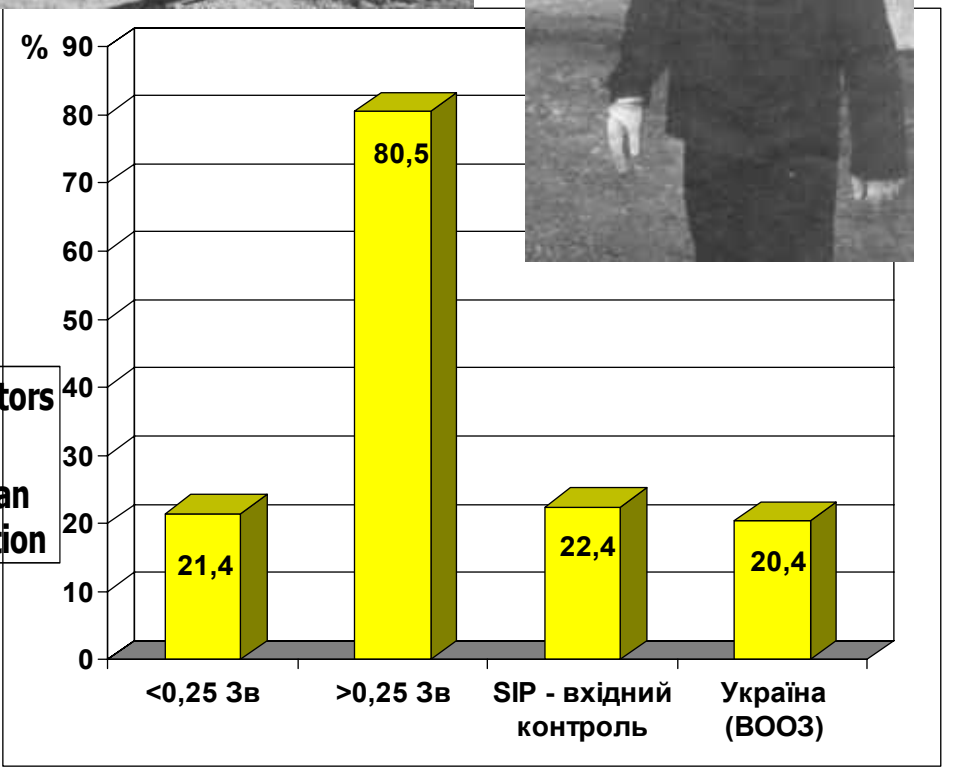
The postradiation brain organic syndrome is compressed by micro focal neurological signs, personality disorders, negative psychopathological symptoms, depression and cognitive deficit. Atherosclerotic changes, hypertensive vessel tonus, interhemispheric asymmetry of blood supply, angiosclerosis, as well as high frequency of stenosis were the causes of cerebral haemodynamics disorders. Brain atrophy, enlargement of ventricula, and lacunar brain abnormalities, supported the cerebral-organic nature of the disorders.



Psychological and neurological problem of liquidators

There is practically two-fold increase of the prevalence of any mental disorders (36%) in liquidators in comparison with Ukrainian general population (20.5%); dramatically increase of the prevalence of depression (24.5%) in liquidators in comparison with Ukrainian general population (9.1%). Anxiety (panic disorder) is also increased in liquidators (12.6% vs 7.1%). At that time, there is no clear cut distinction increasing of alcohol dependence in liquidators (8.6% vs 6.4%).





Evacuation! Pripyat town

Villages

ПЕРЕЛІК
населених пунктів Київської області, віднесених до зони відчуження та безумовного (обов'язкового) відселення внаслідок Чорнобильської катастрофи

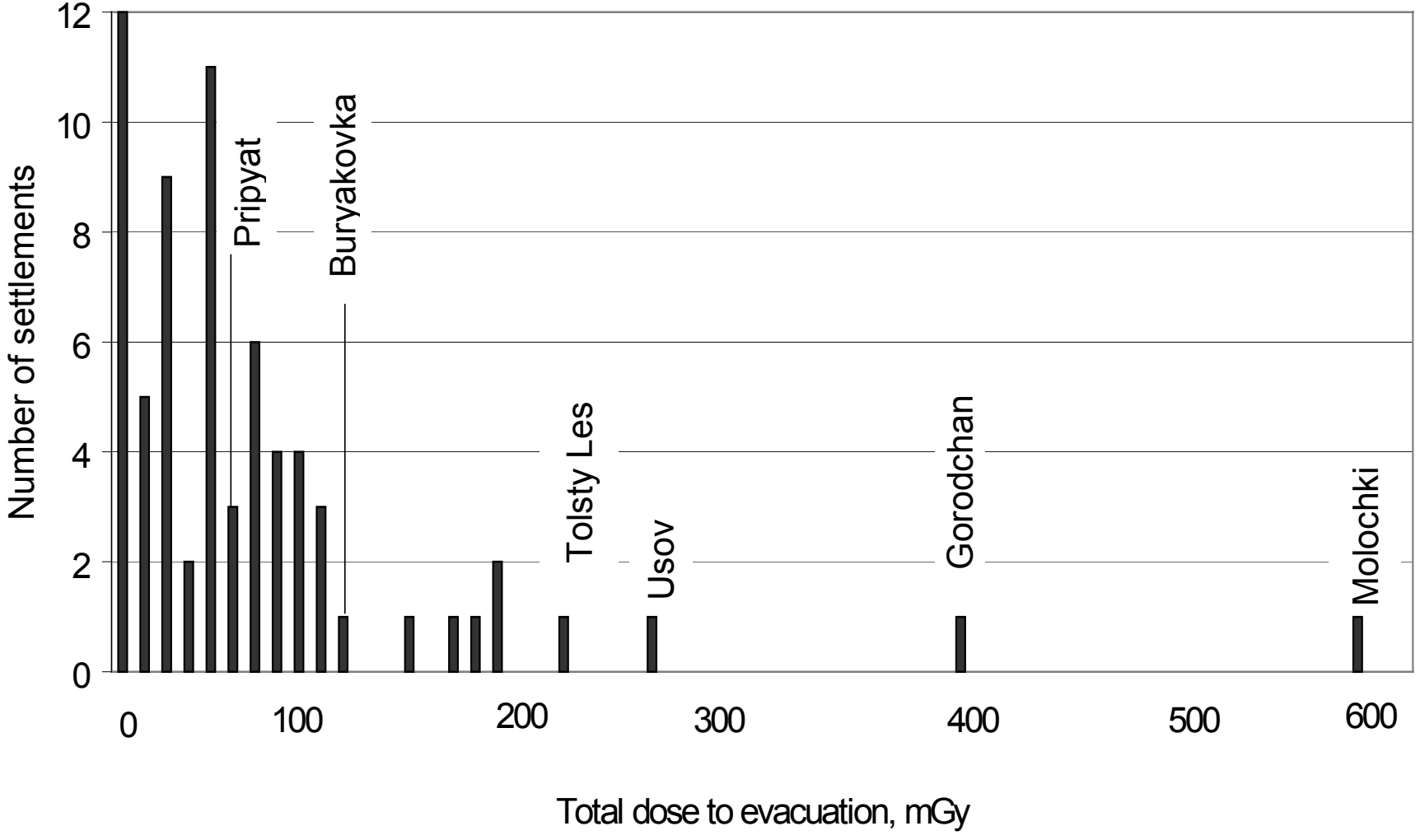
Евакуйовані

Чорнобильський район
с. Андріївка
с. Бенівка
с. Бички
с. Буда
с. Буряківка
с. Глинка
с. Городище
с. Городчан
с. Залісся
с. Замошня
с. Запілля
с. Зимовище
с. Іванівка
с. Іллінці
с. їловниця
с. Кам'янка
с. Копачі
с. Корогод
с. Коцюбинське
с. Кошарівка
с. Кошівка
с. Красне (Машівська
23. с. Красне (Товстоліська с/Р)
24. с. Крива Гора
25. с. Купувате
26. с. Ладижичі
27. с. Лелів
28. с. Машеве
29. с. Нова Красниця
30. с. Новосілки
31. с. Новошепеличі
32. с. Опачичі
33. с. Оташів
34. с. Паришів
35. с. Плютовище
36. м. Прип'ять
37. с. Річиця
38. с. Роз'їжджe
39. с. Розсоха
40. с. Рудня-Вересня
41. с. Рудня-Іллінецька
42. с. Рудьки
43. с. Стара Красниця
44. с. Старі Шепеличі
45. с. Старосілля
47. с. Теремці
48. с. Терехів
49. с. Товстий Ліс
50. с. Усів
51. с. Хутір Золотніїв
52. с. Чапаївка
53. с. Черевач
54. с. Чистогалівка
55. м. Чорнобиль
56. с-ще Чорнобиль-2
57. с. Ямпіль
58. ст. Янів

Поліський район
1. с. Бобер
2. с. Бовище
3. с. Варовичі
4. с. Весняне
5. с. Вільшанка
6. с. Володимирівка
7. с. Кливини
8. с. Ковшилівка
9. с. Лісництво Яковецьке
10. с. Луб'янка
11. с. Стара Рудня

Відселені з 1990 по 2000р.

Поліський район
1. с. Буда-Варовичі
2. смт Вільча
3. с. Грезля
4. с. Денисовичі
5. с. Діброва
6. с. Жовтневе
7. с. Королівка
8. с. Котовське
9. с. Мартиновичі
10. с. Нова Марківка
11. с. Новий Мир
12. смт Полівське
13. с. Пухове
14. с. Рудня-Грезлянська
15. с-ще Становище
16. с. Стебли
17. с. Тараси
18. с. Фабриківка
19. с. Шевченкове
20. с. Ясен


Number of settlements
12
10
8
6
4
2
0
0
100
200
300
400
500
600
Total dose to evacuation, mGy
Pripyat
Buryakovka
Tolsty Les
Usov
Gorodchan
Molochki

vacuees and Resettled
urvivors 164 700 thousand-
NCIDENCE and
REVALENCE
he evacuated adult population
isability indices since 1988 to
003 increased from 4,6% to
03,4%.National Report,
kraine 2006
laps of Kiev oblast. 1
istribution of new villages
hat were build (red points);
Contamination (Cs 137) of
iev oblast.
igure: Morbidity (red line).
revalence (black line).

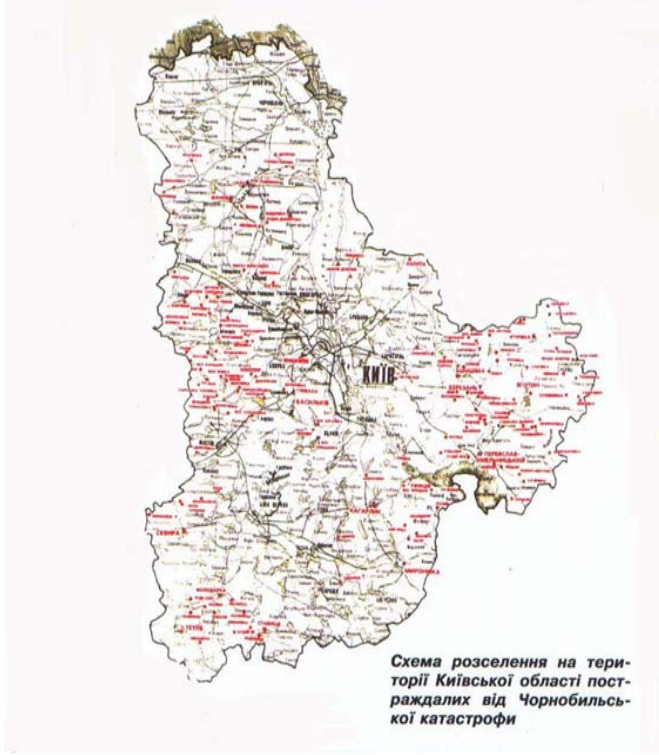
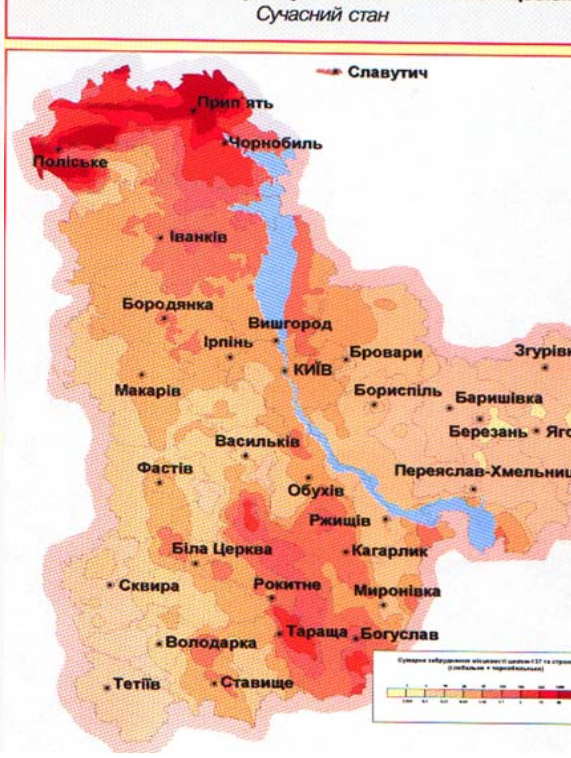
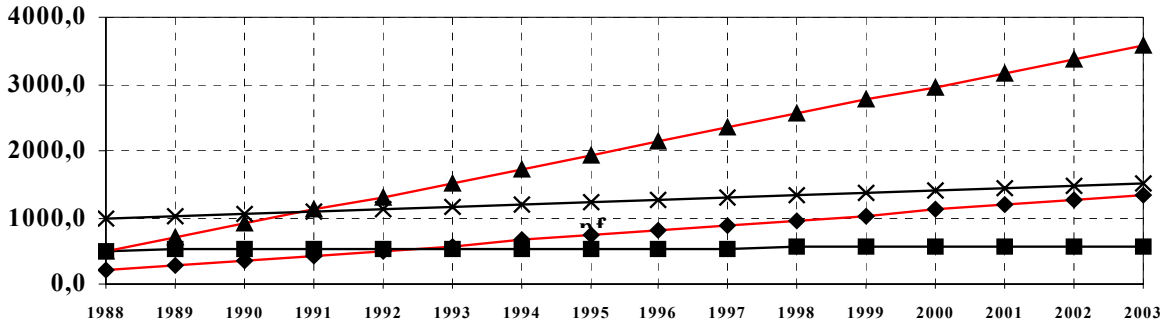


Схема розселення на території Київської області постраждалих від Чорнобильської катастрофи

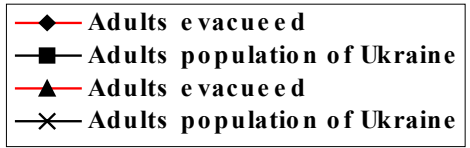




Regression coefficients
1. 8,09 + 3,3
2. 4,8 + 1,3
3. 210,1 + 8,2

Захворюваність

Поширеність



Children health

20% children of Ukraine reside on polluted territories.

60% children of Ukraine in 1986 had been received more than 50 mGr on thyroid gland.

The increasing of index disability on oncology disease-38,2%, hereditary diseases - 34%, blood-8%, gastrointestinal -74,2%.

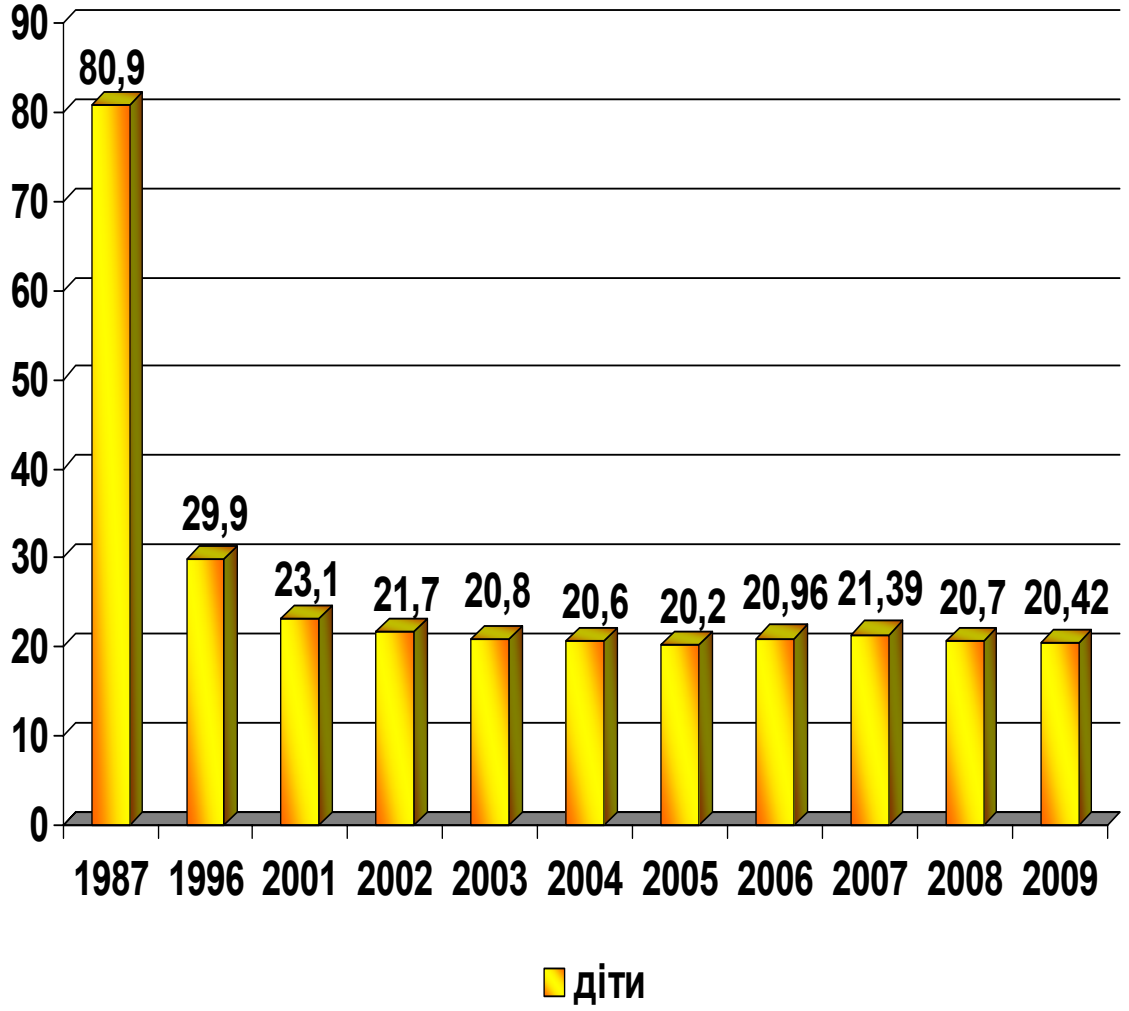
Dynamic of non-tumour diseases prevalence (per 10 000) among children and adolescent affected due to the Chernobyl catastrophe. (State data. 2009).

Presently in the structure of disease incidence of children of 0-14 years predominant are diseases of the respiratory, nervous, digestive and blood systems, skin and subcutaneous tissue diseases. The most unfavorable changes have been observed in adolescents with high doses of thyroid gland irradiation and in adolescent irradiated in utero.

532 families (113 families with children)

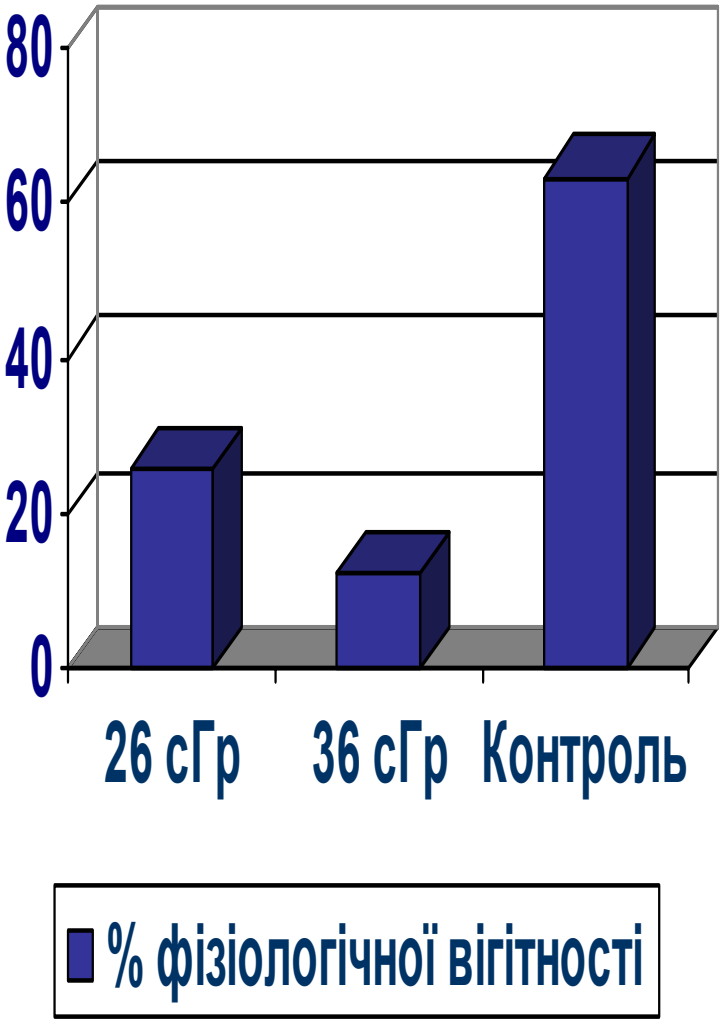
Reside the zone of compulsory evacuation

(1440 Bk on m 2, or 40 Ci on km 2).



Pregnancy and thyroid

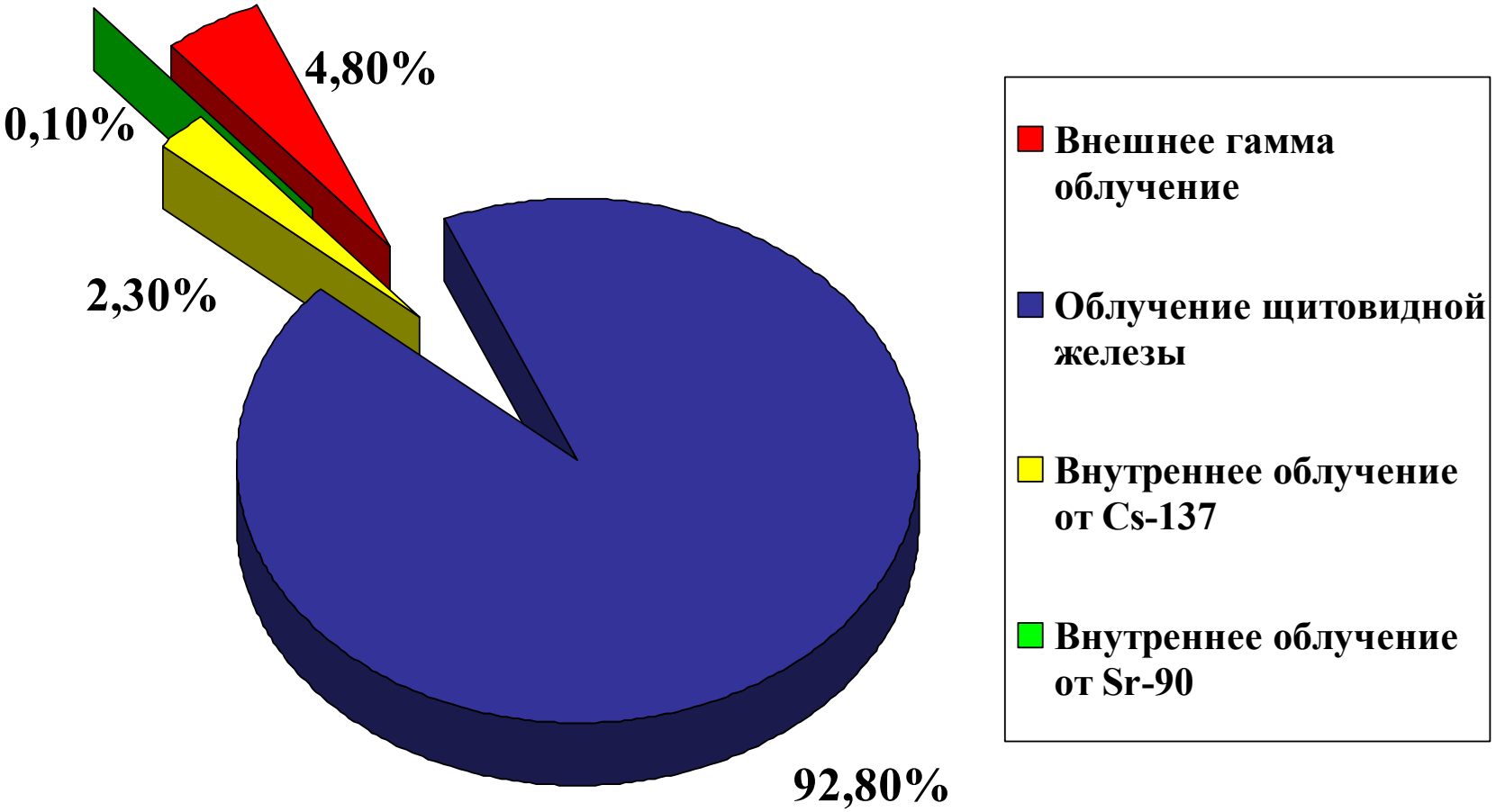
ormal pregnancy - 25.8% (26cGy) and
2.5% (dose 36cGy) and 63,3% in control
roup. Children born by irradiated woman
ecently confined 1,5-2 - fold had more
eflections in physical development.
t was testified that after irradiation in utero
hildren, investigated in 14-16 years age,
ccumulated the cell clones with specific types
f cytogenetic anomalies (which did not lead
o cell death, such as inversions, inserts,
eciprocal translocations). It allows to
uppose that in future we will meet with the
eproductive problems in children, which
ere born after 1986 y. and obtained low
oses of ionizing radiation in utero. This
rocess can complicate the forming of
ametal cells (the meiosis).
Glazko E.I.,2006).



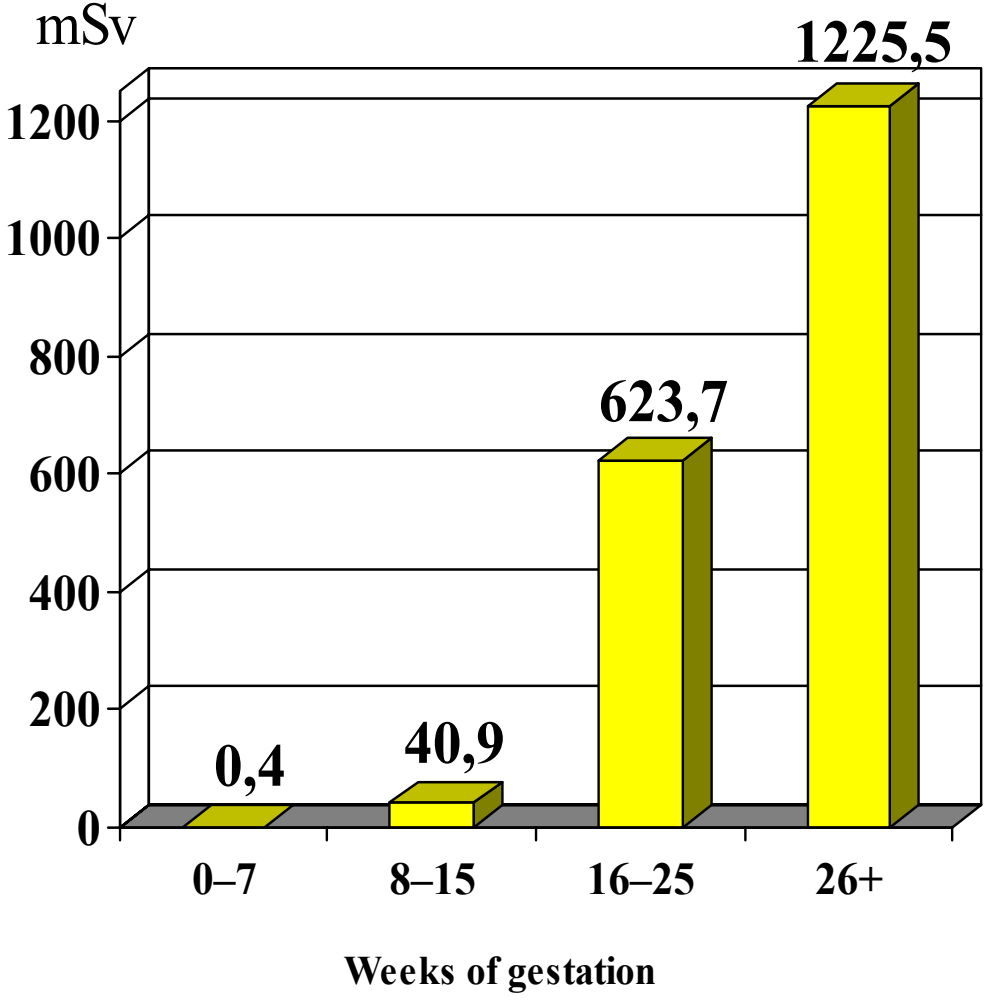
Children irradiated in utero.

Thyroid Dose exposure – in the range 0,1 - 28,5 Gy (I-131,132,129,); Dose of hole-body irradiation - 5,0 - 376,0 mSv due to external gamma –radiation and internal radiation (Cs -137 and Sr-90).

Especially high are the doses to the fetal thyroid. There were children from Pripyat (33.8%) who had been exposed in utero to thyroid doses >1 Sv; (13.2%) received in utero fetal doses of >100 mSv.(Nyagu A.I., Stepanova E.I., Repin V.S. and all.,2000, 2004)



Geometric means of the thyroid doses *in utero* related to the periods of cerebrogenesis at 26.04.1986 in exposed group in Pripyat



According to the model by ICRP-88 there is a strong influence of gestational age on the thyroid doses *in utero*: later intrauterine period at the time of exposure — higher the thyroid doses *in utero*

In UTERO Thyroid doses were estimated 0,01 - 3,34 Gy.

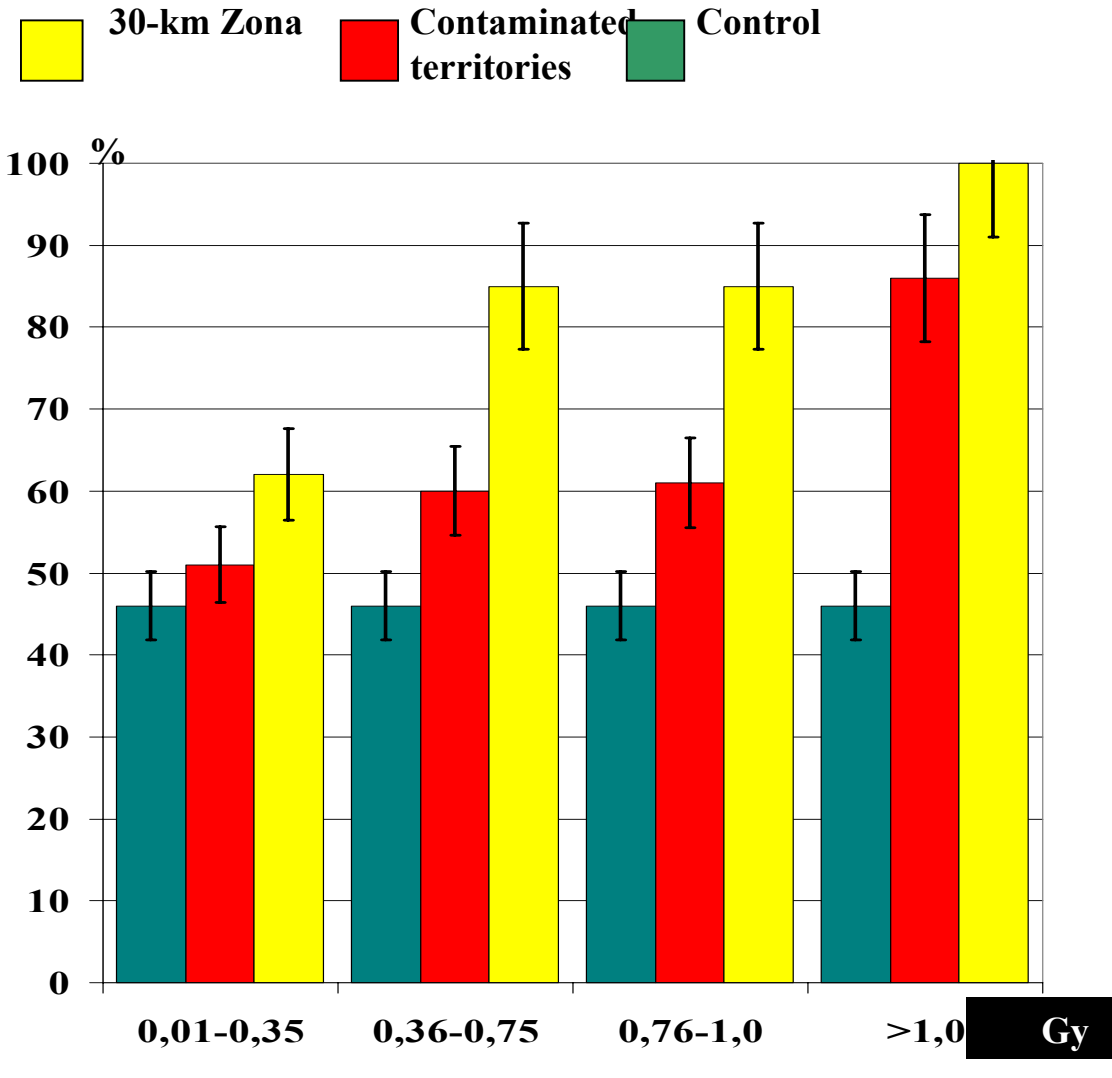
The mean doses according trimester of gestation:

Until 8 weeks – 0,0 Gy;

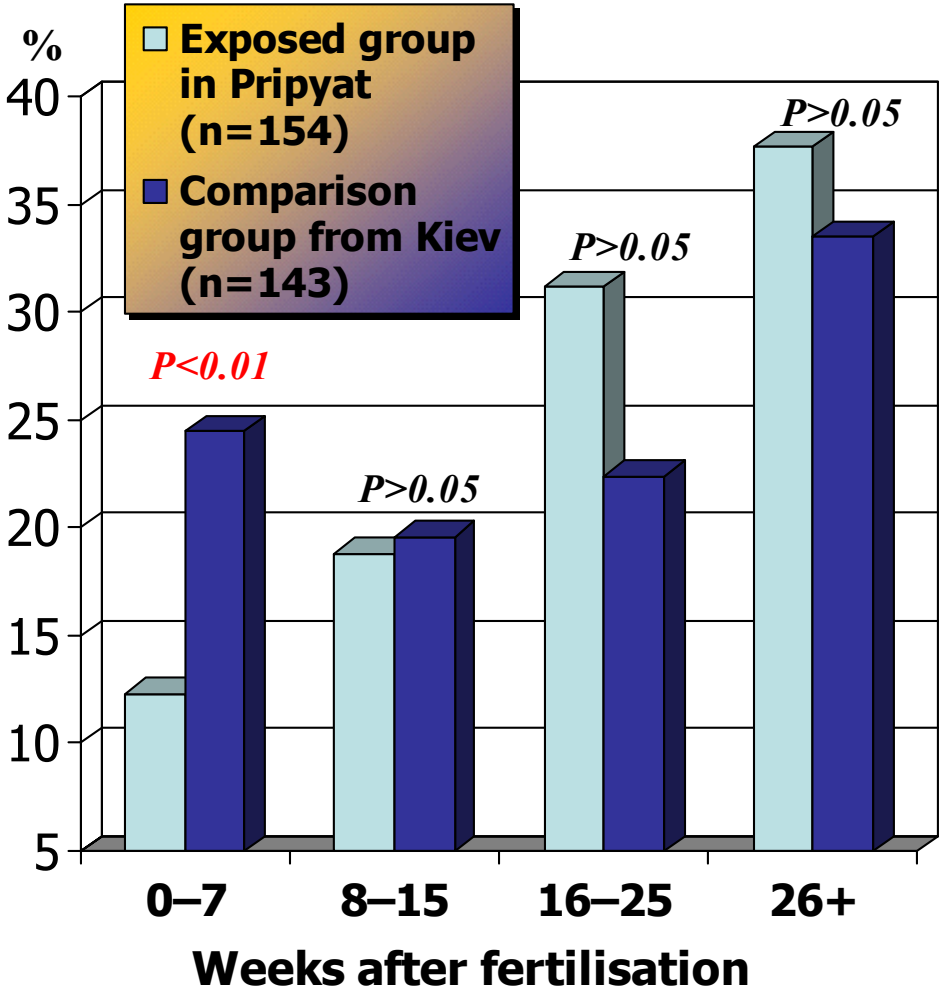
of 8 to 15 week – 0,31Gy;

of 16 to 25 week - 0,8Gy;

More than 25 weeks – 0,62 Gy.



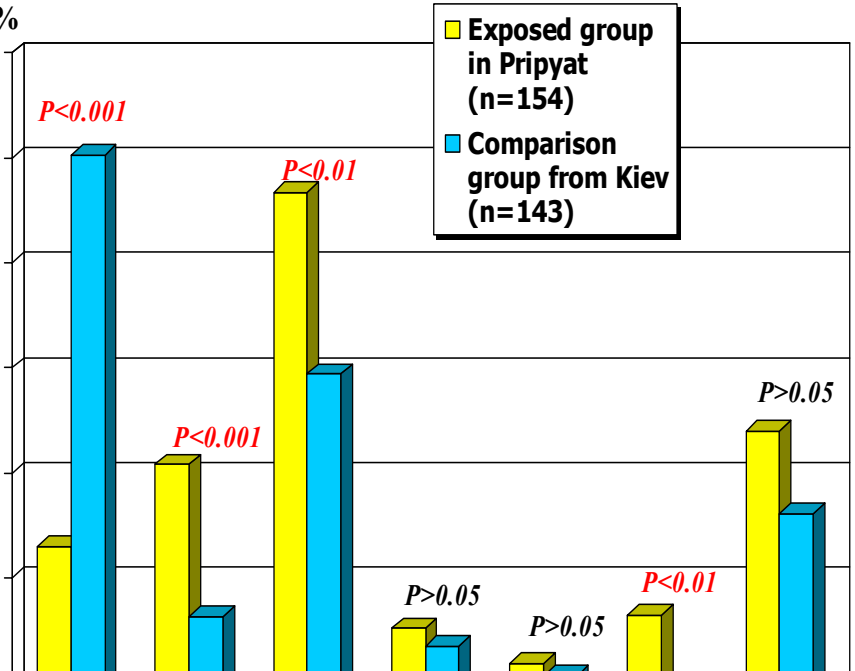
Distribution of children by periods of cerebrogenesis at the time of explosion (April 26th, 1986)

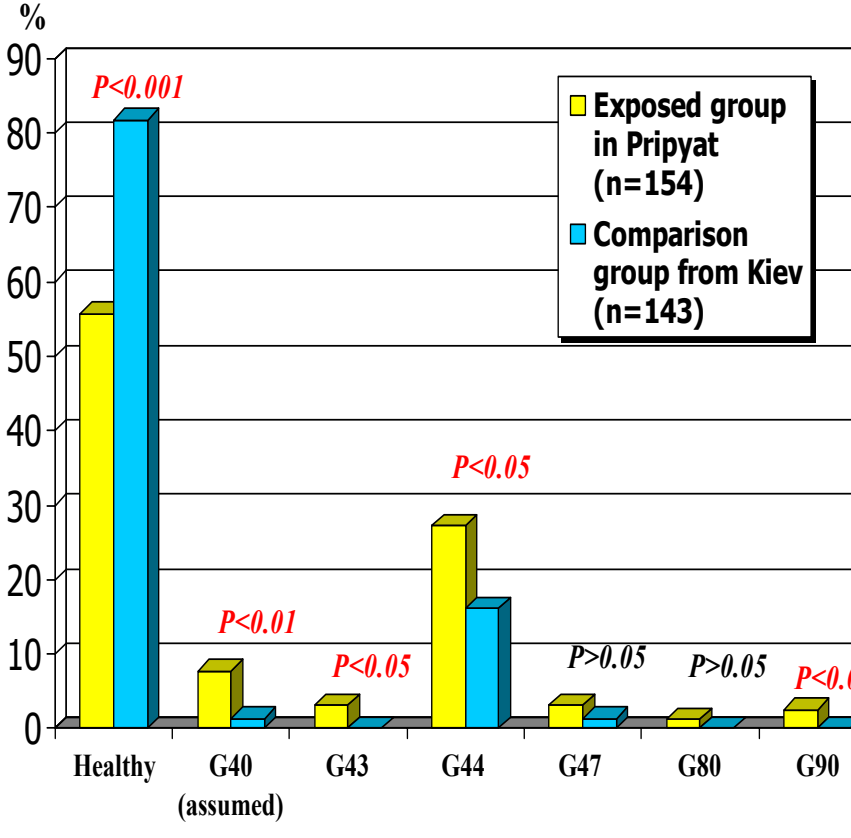


In exposed group there are less children who were at the earliest stages of prenatal development (0–7 weeks after conception) that could be explained with abortions and miscarriages due to the Chernobyl accident

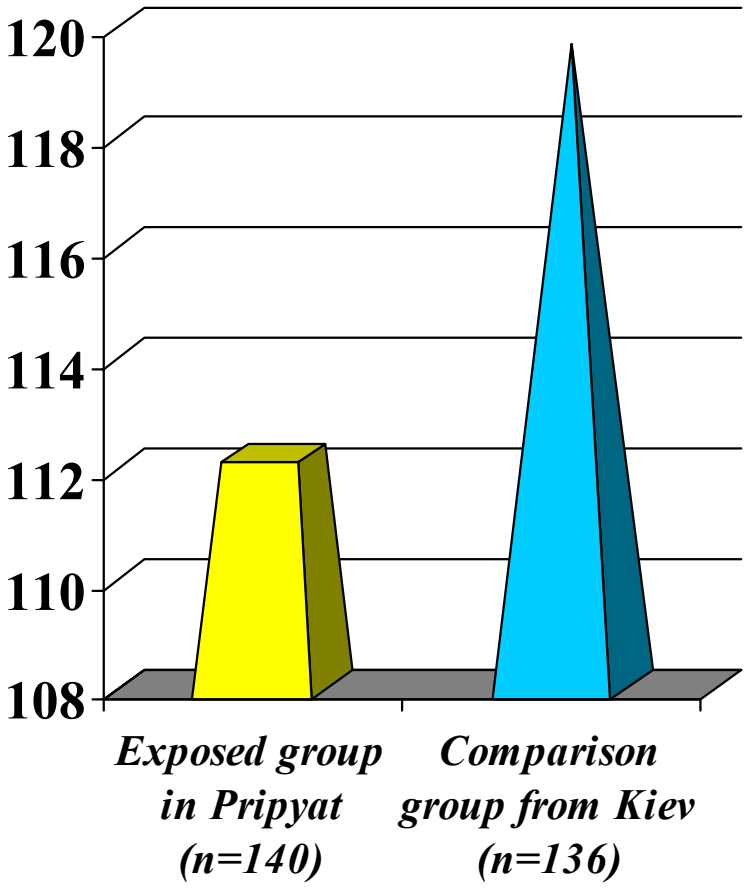
Prenatally exposed children have more neuropsychiatric disorders than the control children from Kiev for the following categories: 1) paroxysmal states; 2) organic mental disorders; 3) neurotic, stress-related and somatoform disorders; 4) disorders of psychological development; 5) childhood behavioural and emotional disorders.

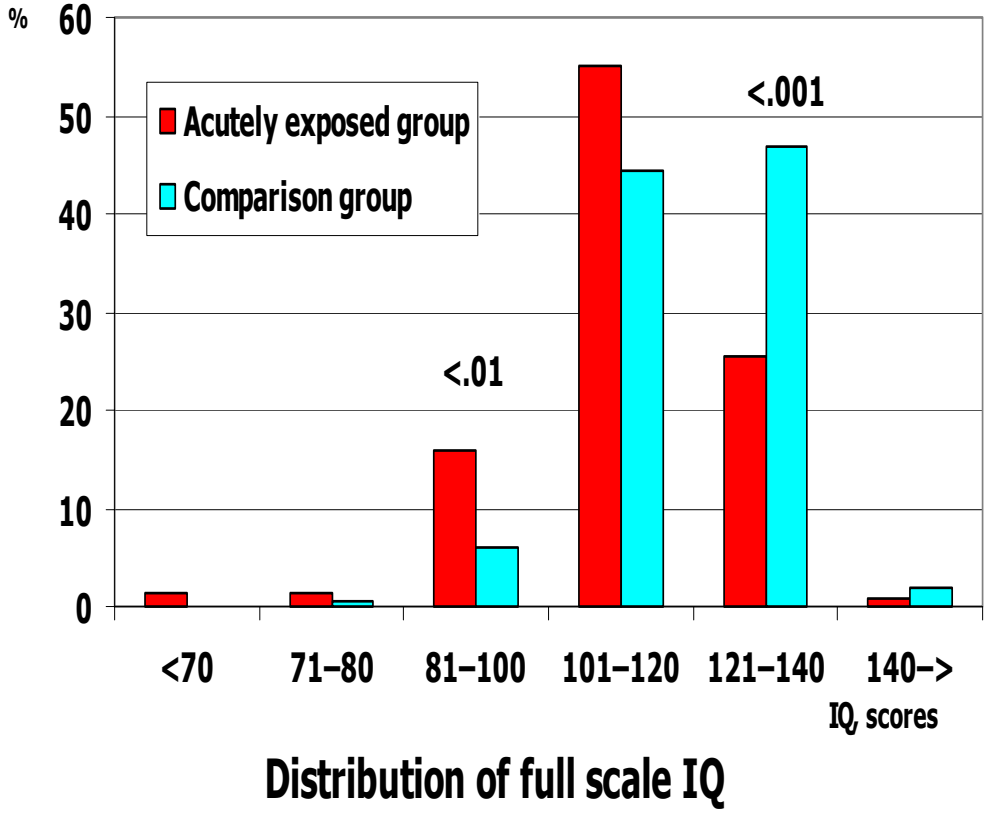
(Nyagu A. and al.)





Wechsler Intelligence Scale for Children (WISC) Full scale IQ

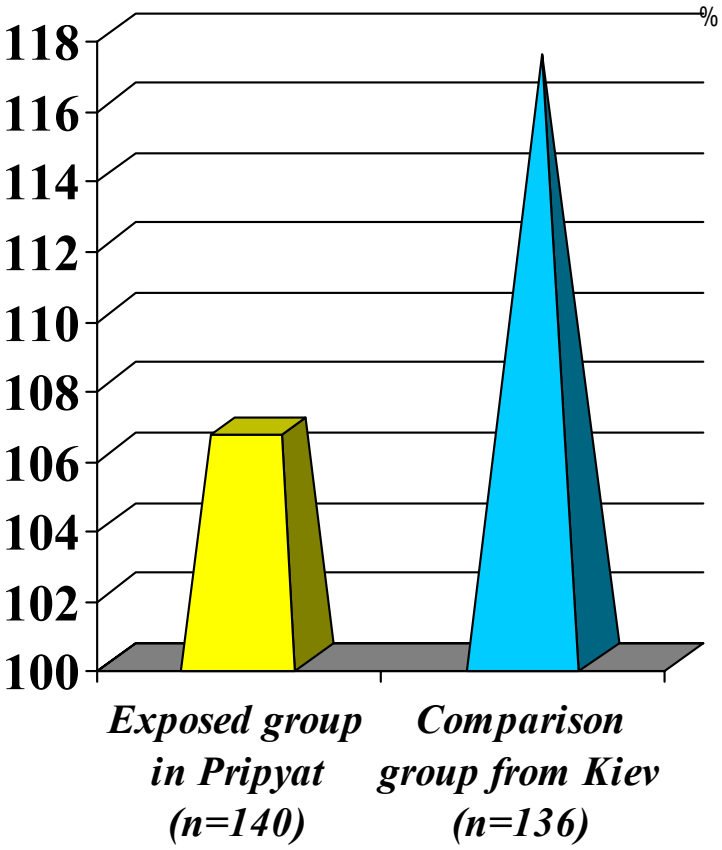


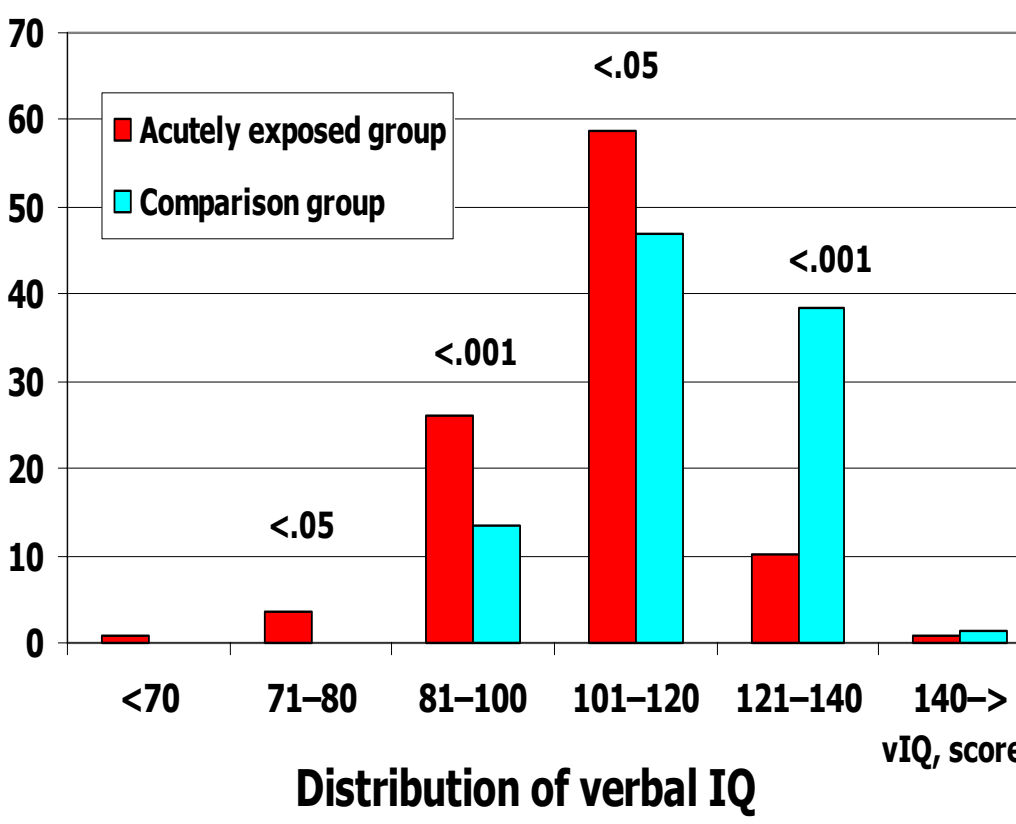


- *Lower full scale IQ*

There are significant (P<0.001) differences on intelligence of exposed children:

Intelligence of children (WISC) Verbal IQ

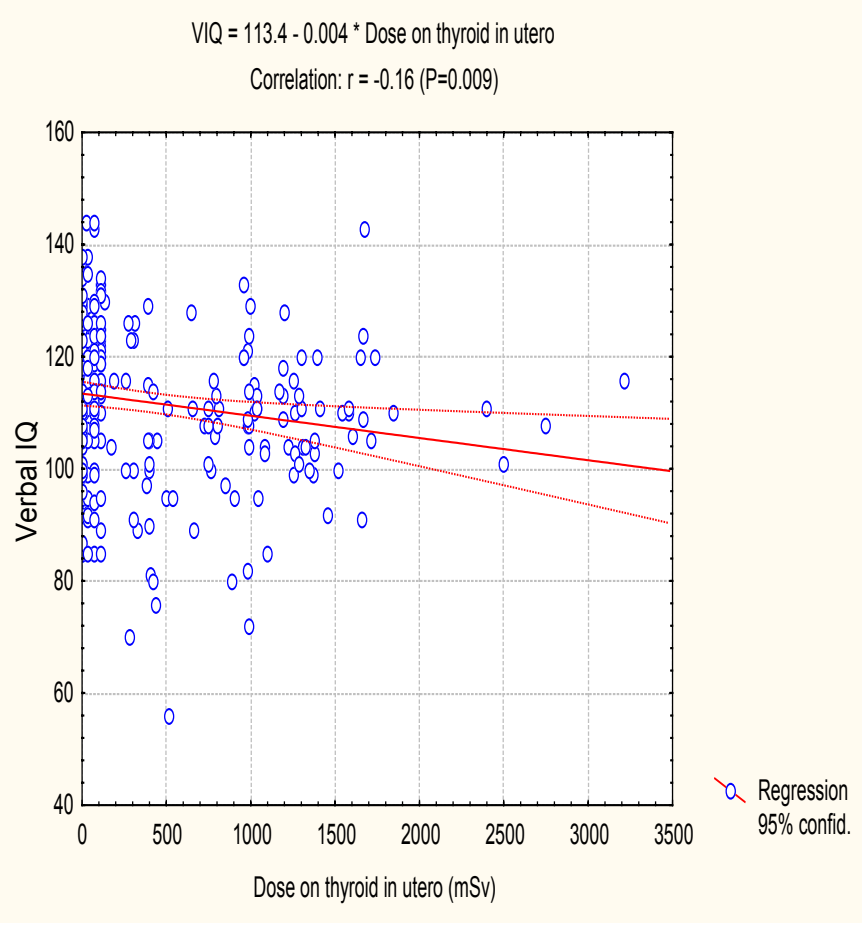


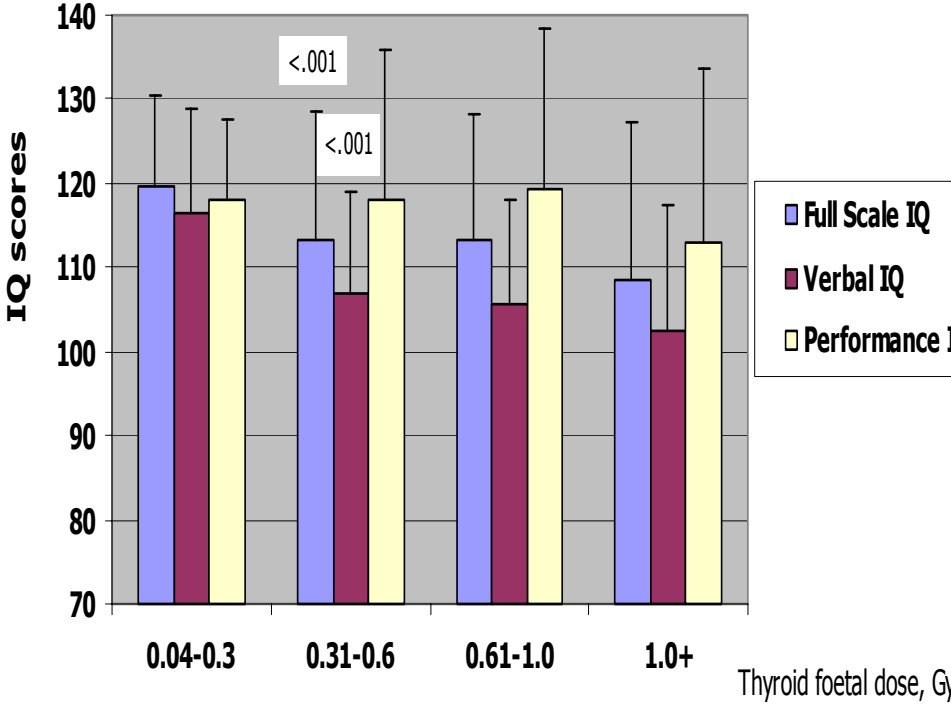


- Lower verbal IQ

There are significant (P<0.001) difference on intelligence of exposed children:the aptitude is more simple with low IQ and less with high IQ in exposed group

Correlations between verbal IQ of children of both groups and dose on thyroid in utero (ICRP-88)





Children intelligence in proportion to the thyroid foetal dose

Children born by exposed parents demonstrate poor health.

The number of healthy children is 2,5-9,2%, (control group - 18,6-24,6%).

This cohort is characterized by a retardation of biological age, immunity disorders, more often manifest external disembriogenetic stigmata, minor malformations of internal organs and congenital malformations, enhanced mutations processes both in indicator cells and target cells. (National Report, 2006).

Возросли показатели общей заболеваемости и заболеваемости по основным классам болезней у детей, родившихся у облученных лиц.

There is a continuous increase in the following changes in the state of health of children in various cohorts under observation:

- among children who were born to Chernobyl liquidators there has been an increase in the incidence of illnesses of the *central nervous system, congenital birth defects and rare forms of genetic anomalies*;

-among children who were exposed during the period of intra-uterine gestation, there is a high risk of developing chronic somatic pathologies, disorders of the thyroid gla pathologies of bone and cartilage, psychological disorders and the development of tumors

- among those who were children or adolescents at the time of Chornobyl accident and subjected to combined exposure to cesium and iodine there have been registered the highest risk of tumors and other illnesses of the thyroid gland.

-experts predict a further increase in pathologies of the thyroid, which will make a robust contribution to the deterioration of the general health of affected populations, and the disruption of reproductive health of young women;

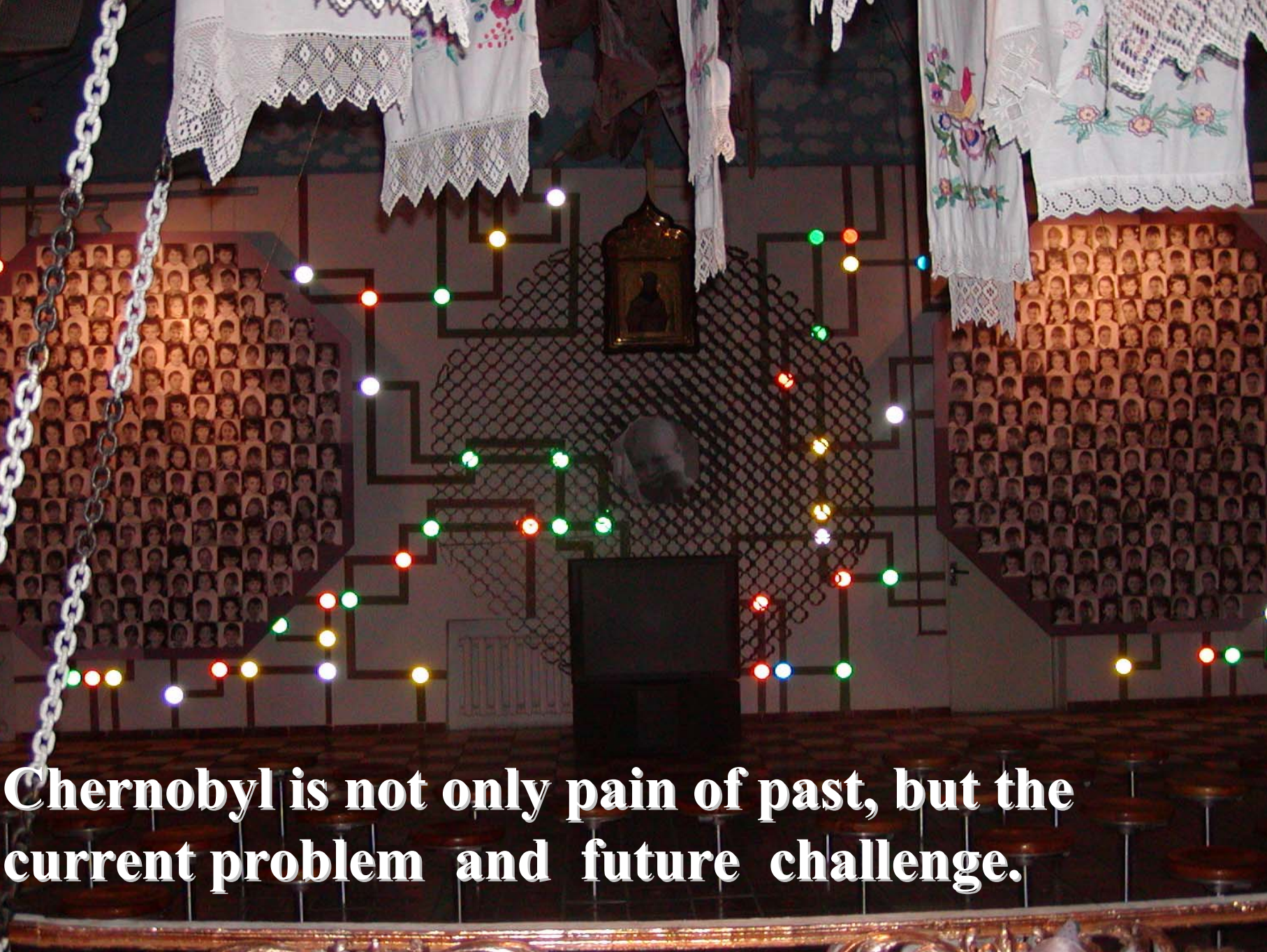
- in the first generation of irradiated persons who continue to live on radioactively contaminated territories, there is also an increasing risk of children born with congenital malformations and hereditary diseases.

Psychological consequences and children

Abnormal psychological development has been detected in 60- 70% of exposed children and teenagers. This is two hold higher than among general population.

The mental state children of all cohorts is significantly worse compared to that of controlled groups: self-sensation as a victim, lack of initiative, rental aims. More than 60% of teenagers see their futures away from home because radiation pollution; Children from the high-risk groups *are becoming the carriers of a crisis psychology* (mentality) and as a result will spread a crisis relationship in society. Inadequate parental or family environments as well as the circumstances of their immediate surroundings – teachers, doctors will contribute to a heightened level of anxiety, fear and lowered self-esteem.

What why the concept of "psychological rehabilitation" should be shifted in the direction of the concept of "education and psychological correction".



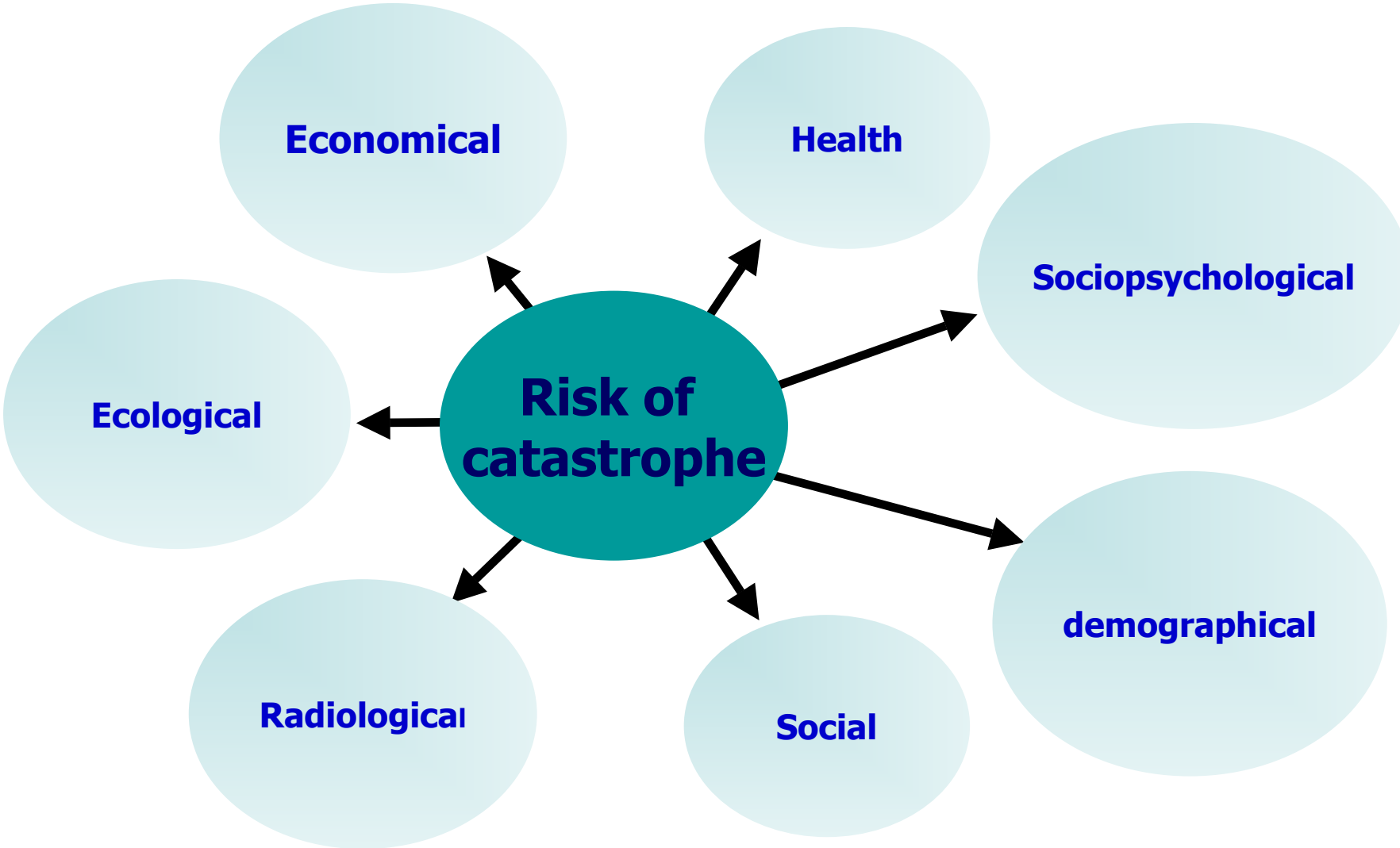
Chernobyl is not only pain of past, but the current problem and future challenge.

Post Chernobyl problems

- **The full effects of the Chernobyl accident will most certainly never be known. However, 25 years after the catastrophe, it is clear that it is far greater than implied by official estimates. Our overall conclusion is that the unprecedented extent of the disaster and its long-term global environmental, health and socio-economic consequences should be fully acknowledged and taken into account by governments when considering their energy policies**
- **The total environmental damage Ukraine in 2015 will amount to 201 billion dollars. U.S.**

Problems that were caused by the disaster, have not disappeared. This is a demographic crisis, the deterioration of the health of hundreds of thousands of victims, lack of economic recovery and socio-psychological stress of the affected population, especially in areas of radioactive contamination.
As a result:
85,1% of Ukrainians negatively related to the construction of storage facility for spent nuclear waste in Ukraine.
63,1% believes that Ukraine should not build new nuclear power plants or units.
81,9% of respondents named a dangerous today Chernobyl. Of these, 48.8% believe that it is very dangerous, 33,1% - more dangerous. Safe for the moment consider the whole Chernobyl 12,4% of respondents.
49.5% believed the accident at the Chernobyl nuclear power plant

Risk assessment of Chernobyl catastrophe



«... Исследования радиационных последствий Чернобыльской катастрофы важны для всего населения Земли. Если эти исследования будут плохо спланированы или их результаты будут искажены, это обернется несчастьем для очень многих людей. Мы не должны преувеличивать опасность, но и преуменьшать ее непозволительно. Небрежная работа или обман в таких исследованиях равносильны ведению войны с невинными людьми.
Способность научной общественности оценить истинные последствия Чернобыльской аварии будет служить критерием нашей цивилизованности и человеческой состоятельности».
Дж. Гофман в кн.: Чернобыльская авария: радиационные последствия для настоящего и будущих поколений.**1994г**.

«Studies of radiation effects of Chernobyl are important for the entire population of Earth. If these studies are poorly designed or the results will be distorted, it will result in disaster for many people. We should not exaggerate the danger, but downplay its inexcusable. Sloppy job or deception in such studies are equivalent to waging war against innocent people.
The ability of the scientific community to assess the true impact of the Chernobyl accident will serve as a criterion of our civilization and human consistency».
J. Hoffman in the book.: The Chernobyl accident: radiation effects on present and future generations.1994y.

Чернобыль: фактор человека

Альфа и Омега
Начало и Конец

Купол церкви в Красные.

Церковь в Красные сейчас
инута и находиться в запустении

Величина потери не может быть измерена на уровне цивилизации, которая покинута и приходит в упадок в тени Реактора. Она может быть найдена только путем сложения бесчисленного количества Маленьких вещей.

Население Припяти было эвакуировано 36 часов после аварии на 1500 автобусах. Людям было сказано брать только самое необходимое и быть готовыми покинуть дома только на три дня.

Это фото Ленина было в шк
Красные. Кочерга проткнул
фотографию между глаз вож
на лбу нарисована свастика

Советский флаг все еще висит над входом в школу в Красные. Разбросанные книги - в основном, биографии Ленина. Надпись на доске гласит: "Занятия отменяются."

Школьники ездили на велосипедах
этот мост 26 апреля 1986, чтобы
смотреть как горит реактор.

Разбросанные принад
ности, так как в дерев
Машево, свидетельст
о спешке, с которой б
эвакуировано населе

Подготовка к майским праздникам была в разгаре, когда произошла катастрофа

The University of Georgia

Texas Tech University

*Данные предоставлены Чернобыль ИнтерИнформом.