R E P O R T

on implementation of milestones of the 4 quarter of the second year
of the Joint Ukrainian-American Scientific Project

«Study of Thyroid Cancer and Other Thyroid Diseases in Ukraine Following the Chornobyl Accident»

(March 1998 - May 1998)

1. Management and administering

1.1. To complete equipping of the Data Coordinating Center (software and hardware) and Project office (copy machine, telefax).

Computers for the Data Coordination Center, fax-machine and copyers for the Project Office have not yet been received.

1.7. To organize in March, April and May 1998 joint meetings of the Leaders of the Ministry of Public Health and Administration of the Ukr.-Am. Thyroid Project with participation of main executors of the Project concerning Project implementation.

Joint meetings of the governing body of the Ministry of Public Health and the administration of the Ukrainian-American Project have been organized and held on March 4 and May 19, with participation of the main Project executors.

1.8. To prepare all necessary custom documentation for the equipment received in the framework of the Project, make inventory of this equipment.

Custom documentation for equipment which has been received according to the Project for the reported period, has been prepared. An inventory of equipment has been made.

1.9. To train a group of interpreters in order to ensure communication during the visits of American colleagues.

A group of interpreters (4 specialists) has been trained in order to ensure communication during the visits of American executors of the Project to the Institute.

2. The establishment of the cohort

2.4. To analyse all the data obtained from the controlled regions as a result of computer and manual search.

Manual search has been continued for potential cohort members who resided on areas controlled according to the Project, whose data were lacking in the computer bases of oblast departments of Public Health and raion medical institutions of the regions under control.

Data on electronic carriers (diskets) have been obtained from the district hospital of the Ovruch raion for 2157 cohort members. Among them 8 persons have left the Ukraine; 144 persons have left the Zhytomyr oblast for other regions of Ukraine; 67 persons have moved to other raions of Zhytomyr oblast; 1926 persons reside at the present moment in the Ovruch raion of Zhytomyr oblast; the status of 12 persons has not been established. Thus, from the data on 3073 persons, which have been provided to the raion, 1926 have been found in the Ovruch raion, what makes 63%.

For June 1, 1998 the 20000 strong cohort has the following structure:

Rayon		Finding			%
	Total	in Chern.Reg	Manual search	Total	in Chern.Reg
Chernobylsky	1484				
town Pripiat	1584				
Polessky	1399	511			36.53

Ivankovsky	2787	378	297	494	50.61
Kyiv oblast	**5204**	**884**	**297**		**16.99**
Kozeletsky	2089	215	1156		10.29
Repkinsky	1377	572	793		41.54
Chernigovsky	2858	997	1386		34.88
city Chernigov	1179	51	1024		4.33
Chernihiv oblast	**7503**	**1835**	**4359**		**24.46**
Narodichsky	4279	811	1256		18.95
Ovruchsky	3072	714	1926		23.24
Zhytomyr oblast	**7351**	**1525**	**3413**		**20.75**
city Kyiv		**542**	**413**		
Total	**20058**	**4786**	**8482**		**23.86**

2.5. To definitely form lists of 20000 cohort members according to verified addresses of their residence.

Input into the computer of data obtained as a result of manual search in the Chernihiv oblast has been continued. Data on 372 persons have been entered for the Kozelets raion of Chernihiv oblast. Among them 260 persons reside at present in the Kozelets raion. Data on 631 persons have been entered for the Chernihiv raion of Chernihiv oblast. From them 482 persons are living at present in the Chernihiv raion. In all, data on 1003 persons have been entered, from whom 742 persons did not change their raion of residence, what makes 74%.

The other persons are distributed as follows:

Raions	Chernihiv	Kozelets	Total
not found	19		19
moved to another oblast of Ukraine	10		10
left abroad	4	3	7
left in unknown direction	78	32	110
provisionally absent in the settlement	11	8	19

deceased	1	1	2
double records	26	5	31
provisionally residing in the settlement		63	63
Total	149	112	261

2.6. To select from the lists of potential cohort members who have a verified address of residence the persons born in 1980 - 1984.

Persons have been selected from the cohort, who have a date of birth in 1980-1984. This has been made in order to examine in the first instance the persons who have to graduate from the secondary schools this year.

Rayon (code)	Total	9-11th forms	%
Chernobylsky (1024)	1484	537	36.19
town Pripiat (1032)	1584	611	38.57
Polessky (1017)	1399	418	29.88
Ivankovsky (1010)	737	156	21.17
Kozeletsky (2507)	2089	775	37.10
Repkinsky (2516)	1377	432	31.37
Narodichsky (0613)	4279	1064	24.87
Ovruchsky (0615)	3072	1117	36.36
Chernigovsky (2521)	2858	821	28.73
city Chernihiv (2523)	1179	433	36.73
Total	20058	6364	32.10

3. Invite the subjects for endocrinologic screening

3.1 To send invitations to cohort members born in 1980 - 1984 with verified addresses of residence in all raions in order to obtain their preliminary consent for participation in screening.

Invitations have been sent to potential cohort members who were born 1980-1984 and are currently living in Ivankiv raion. Since the beginning of screening in the other raions was postponed, invitations have not been sent. Cards with consent to take part in the examination have been analysed.

Number of written invitations sent to the Ivankiv raion in January, 98: **494**
Number of cards received back: **147**

These cards were distributed as follows:

Returned without any marks	29
Agreed to come	102
Changed the place of residence	12
Refused to come	4

In order to ensure the work of the Institute's screening center, it has been decided to invite for examination persons who currently live in Kyiv and had been resettled from Chornobyl and Prypyat. Using the database of the National Chornobyl Register and local medical file of Vatutinsky district polyclinic, it has been found 542 members from the 20000 cohort, who are now living in Kyiv.

These persons have been invited on the telephone.

Number of people invited	Number of people examined	Period of time when inwitations took place	Subjects who were supposed to call back and didn't	Missing ☎	Wrong ☎	Refused to come for examination	Telephone contacts: total
125	72	1.05-29.05	64	50	5	8	188

30,3	17,4	%	15,5	12,1	1,2	1,9	45,5
		TOTAL: 413 persons					

Among 125 cohort members with a settled appointment, 72 persons, or 57,6% have come for the examination.

3.2. On the base of the answers received, to make a schedule of screening of the population of Ivankiv, Polisya and former Chornobyl raions, born in 1980 - 1984.

Schedule of the examination of potential subjects in Ivankiv raion born in 1980-1984 was established by local medical staff, based on the results of personal contacts with potential cohort members.

The schedule of examination of inhabitants of Kyiv who had been resettled from Prypyat and Chornobyl, was established based on the results of telephonic invitations. Examination of 20 persons a day was planned.

The schedule of screening of the population of Polisya and former Chornobyl raions born in 1980-1984 has not been made because of postponing the date of beginning of screening in these raions to later terms.

3.3. To publish in the Polisya local newspaper an article clearing up the purposes of the screening of the population of Ivankiv raion in the framework of the Ukr.-Am. Project.

In April 1998 an article was published in the Ivankiv local newspaper entitled "Reveal thyroid diseases in time". The date of publication in the Polisya local newspaper was changed because of postponing the date of beginning of screening in these raions to later terms.

3.4. To give a broadcast talk on the local radio of Polisya raion to inform the population about purposes and tasks of the Ukr.-Am. Thyroid Project.

Before the beginning of screening, talks have been given explaining the goal and advantages of the screening on the local radio of Ivankiv raion.

4. The endocrinologic examination of the subjects

4.2. To begin screening of cohort members born in 1980 - 1984 who reside in Ivankiv and Polisya raions of Kyiv oblast.

Beginning from April 14, 1998 medical screening of the cohort in order to identify thyroid and parathyroid pathology has been started.

Examinations have been performed by mobile teams (three teams were operating, which performed screening in the Ivankiv raion in the following periods: from April 14 to April 17, 1998 /Rakov O.V/; from April 20 to April 24, 1998 /Savosko I.I./; from April 24 to April 30, 1998 /Kulchytska N.O./), and by the stationary team (on the basis of the Institute's clinic from May 12 to May 31, 1998). .

103 patients have been examined by mobile teams. The stationary team have examined 68 patients who reside in the city of Kyiv and had been evacuated in April-May 1986 from the 30-km zone of radiation contamination.

The age of the persons examined was in the range 12 to 29 years.

The following pathology has been revealed in the subjects examined:

Diffuse goiter, grade 1 - in 16 patients.

Diffuse goiter, grade 2 - in one patient.

Autoimmune thyroiditis was suspected in 4 patients based on clinical and echographic signs. All the patients have been referred for stationary examination on the basis of the Institute's Clinic.

Nodular forms of goiter have been revealed in 4 persons.

FNAB has been performed in three of these patients. Cytologic study of nodules' tissue have shown signs which are typical for nodular goiter.

FNAB has not been performed in one patient, male, born in 1975, because of the small size of nodules (7 mm in diameter, symmetric shape, with clear-cut contours, normal echogeneity) and impossibility of obtaining a sufficient amount of biopsy material. The patient will be followed up. The next examination is recommended in 3 months.

One patient (male) residing in the Ivankiv raion, with an increase in the volume of the submandibular lymph node and a complicated anamnesis (the patient's mother has been operated for a thyroid cancer) has been referred for FNAB of the lymph node. Cytologic study has revealed unchanged lymphatic tissue.

The final diagnosis for the persons examined has not been established because of absence of findings of hormonal assays.

In one patient (female), born in 1976, residing in the village of Shpyli, Ivankiv raion, a postoperative hypothyroidism of middle degree of gravity, at compensation stage, has been revealed.

5.2. To perform all the laboratory tests in the process of screening.

In all the patients examined blood sampling for Ca++ and pH determination as well as for hormonal assays has been performed.

Ca++ and pH have been assessed in 253 patients.

Since the kits for blood hormonal assays from the company BRAHMS will be received in September, blood samples have been frozen at t = -18 C. After receipt of kits and verification of the counter functioning, these investigations will be carried out.

Since the reagent kits from the company AMERLITE for determination of blood contents of thyrotropin and free thyroxine have been received, these investigations have been performed in 162 patients.

6.1. To receive equipment according to the Protocol. Installation of the local network and software.

Necessary software has not been received. This milestone will be completed only after receipt of equipment.

6.2. Installation, studying and management of the database InterBase server.

Necessary software has not been received. This milestone will be completed only after receipt of equipment.

6.3. Recompilation of available databases into InterBase format.

Necessary software has not been received. This milestone will be completed only after receipt of equipment.

6.11. To enter the data obtained by manual search in Ovruch and Narodychi raions.

See milestone 2.5.

6.13. To work out a complex of programs for the Pathology Group operation.

Due to the absence of a local network between the DCC and Pathology group, this milestone has not been completed.

In order to support screening, a complex of programs has been worked out for printing labels on test-tubes and examination forms with patients' bar codes, as well as forming, printing of registers. DCC has also provided support for the mobile teams in Ivankiv raion and on the basis of the Clinic of the Institute of Endocrinology: printing of invitations, postcards, registers, examination forms, labels with patients' bar codes, as well as their processing.

7. Pathology support for diagnosis of various forms of thyroid pathology.

7.1. To continue collecting and pathological examination of morphologic material from all patients born in 1968 and later from cohort oblasts and having been operated at the Institute of Endocrinology for different types of thyroid pathology.

Collection of biopsy material has been continued in the form of paraffin blocks and histological preparations from patients born in 1968 and later, who reside in Kyiv oblast (including city of Kyiv), Chernihiv, Zhytomyr oblasts and have been operated at the Clinic of the Institute of Endocrinology during the reported period for different types of thyroid pathology. For the period March - May 1998, material from 33 cases of surgical thyroid pathology has been collected. They include 9 cases of thyroid carcinoma (all cases from Kyiv oblast); 4 cases of follicular adenoma (2 from Kyiv oblast and 2 from Zhytomyr oblast); 15 cases of nodular goiter (11 from Kyiv oblast, one from Chernihiv, and 3 from Zhytomyr oblast); 2 cases of multinodular goiter (one from Kyiv oblast and one from Chernihiv oblast), and 3 cases of diffuse toxic goiter (2 from Kyiv oblast and one from Chernihiv oblast).

With diagnostic purpose, more than 150 blocks have been embedded in paraffin, and more than 300 histological preparations have been studied at light microscope.

All the studied cases of thyroid cancer represented a papillary carcinoma, 5 tumors of this type were removed in children aged up to 15 years (one tumor from the above cases represented a papillary microcarcinoma); one case took place in an adolescent aged 15 years, and 3 tumors were removed in young adult patients aged 20 to 28 years.

As to their histological structure, the tumors in children had a dominant solid structure in 2 cases (one of them was a microcarcinoma), a mixed solid-follicular or solid-papillary structure also in 2 cases, and a typical papillary structure with signs of marked oxyphilic-cell metaplasia in one case. Metastases of carcinoma in regional lymph nodes were morphologically determined in children in 2 cases (40%) in the presence of solid and solid-follicular structure of primary tumor. An encapsulated typical papillary carcinoma with presence of metastases in lymph nodes has been identified in an adolescent. In adult patients in 2 cases carcinomas were encapsulated and had a typical papillary and follicular structure, and in one case there were signs of mixed papillary-solid growth and presence of metastases in lymph nodes (33%).

7.2. Preparation of additional histological specimens for morphologic data bank of the Ukr.-Am. Project (after identification of concrete patients included in the cohort).

A detailed information on the above cases, which contained patient's passport data, exact date of birth, place of residence during the accident and at the present moment, has been provided to the Dosimetry Department of the Scientific Center of Radiation Medicine and to DCC in order to identify persons who had direct measurements of thyroid activity and were included in the cohort. It has been established that none of the 33 subjects who have been operated during the reported period belonged to the cohort under study.

Thus, in the morphologic data bank of the Ukr.-Am. Project among the cases identified in the cohort, at the present moment 22 cases of thyroid carcinoma have been determined (9 belonged to the group "C", 4 to the group "B", and 9 to the group "A"); in addition, in 3 cases paraffin blocks and histological preparations are missing, and in one

case paraffin blocks are missing (these patients have been operated in other clinics and now one tries to get into contact with these establishments). Six cases of benign pathology (2 follicular adenomas, 2 multinodular goiters, one nodular solitary goiter, and one diffuse toxic goiter) have been identified in the cohort.

7.3. To ensure intraoperational diagnosis, histological processing and pathomorphologic analysis of specimens received from patients selected for surgery after screening. Preparation of additional histological preparations for the morphologic data bank of the Ukr.-Am. Project.

Screening examinations performed to date allowed to identify two patients (one child born in 1985 and one adolescent born in 1982) with nodules in thyroid gland measuring 7 and 9 mm, respectively (according to USI data). According to FNA results, these nodular formations had a benign character, and, therefore, these patients are followed up by endocrinologists without surgical intervention and further morphologic studies.

7.4. To begin application of the Pathology Form in the process of work by the Laboratory of Morphology (together with DCC after receipt of computer equipment).

The Pathology Form has been additionally abridged in part, and a pattern of it was made in Word 6 program (together with DCC) and sent to the USA. Since the computer equipment has not yet been received, the Forms have been printed and filled in on paper for all cases of thyroid pathology in the patients identified in the cohort (22 cases of carcinoma and 6 cases of benign pathology). The Forms completed and corresponding histological preparations have been reviewed together with the American colleagues (Dr. R. McConnell, Dr. E. Greenebaum), and there were no remarks on their part.

8.14. RECURRENT VERIFICATION AND CORRECTION OF INFORMATION ON CONDITIONS OF MEASUREMENTS AND CALIBRATION OF DEVICES (FORMING OF NEXT VERSION OF DB MEASURE-1998)

INTRODUCTION

All the information on thyroid activity measurements is structured according to lists. DB of direct measurements of thyroid activity consists of 1087 lists gathered in 122 files. Each list contains thyroid activity measurements performed on the same day, at the same place, by the same dosimetric team, using the same device and the same method. The number of measurements in a list averages 140, but it may vary within the range 1 to 1316 measurements (the list may include all the measurements made by the same team during a 12-hour working day, or the measurements made during a part of the day, or in particular cases even a single measurement). The data which characterize the process of measurements are given for each separate list on the title page. These data being collected together for all lists and formalized, represent DB of characteristics of the process of measurements "MEASURE".

The lists were filled in by different teams (the team codes known to us are given in Table 8.14.1), and completeness of information on characteristics of the process of measurement is different from one list to another.

The measurements were performed by spectrometric (310 lists) and non spectrometric (777 lists) devices.

All spectrometric devices were calibrated in the process of measurements according to the control source of I-131; a part of non spectrometric devices was also calibrated in the process of measurements (194 lists). The result of calculation of calibration factor was noted on lists for all the lists with measurements made with spectrometric devices., and for 55 lists with measurements made using non spectrometric devices.However, an analysis of these factors showed that they were calculated after the data of one - two measurements of calibration source, while the list might contain the results of up to 10 - 12 measurements of calibration source, and values of factors might change with time (and also because of changes in temperature characteristics of the device and parameters of its electronic circuits).

The aim of this work is:

1) An analysis of data in DB "MEASURE" necessary for verification and correction of information on conditions of measurements and devices' calibration, as well as completion of input of information, which has not been formerly set into, from primary sources (paper carriers).
2) A retrospective restoration of necessary information missing in primary sources.
3) A verification of information on the conditions of measurements and recalculation of calibration factors of devices.

8.14.1. VERIFICATION OF CHARACTERISTICS AND CONDITIONS OF MEASUREMENTS

8.14.1.1. Input of information on dosimetric teams and its analysis

Initially, information on dosimetric teams was not set into computers and was not used for data analysis. But as each dosimetric team was working with a concrete set of instruments and on concrete areas, information on teams may be useful for the analysis of devices' characteristics and restoration of missing data on the devices. In addition, this information may allow to perform search of dosimetrists who have made measurements. With this purpose, the following work was performed: all available information on dosimetric teams was set into computers and its further analysis has been performed. Information on dosimetric teams includes the following data:

- Team's identification code
- Place (oblast) of measurements
- Dosimetrists's surname.

A characteristic of available data is given in Table 8.14.1.

Judging from the number of differing codes, 58 dosimetric teams have been working. Among all available lists, 36.9% have no indications of team's identification code, 56.7% of lists do not bear the signature of the dosimetrist, or this signature is so illegible that it may not be read.

The following problems are to be resolved in further investigations:

- to analyse displacement of dosimetric teams on different areas;
- to determine the set of instruments which each team has been using;
- proceed from team's identification codes and surnames of team members, to try to restore devices' Numbers in case they are not indicated in primary sources.

8.14.1.2. Analysis of information on the devices having been in use

Information on the number of devices having been in use may be obtained by verification and analysis of information on devices' serial Numbers. Description of information on devices' serial Numbers, verified and introduced into a new version of DB MEASURE, is given in Table 8.14.2. Information is necessary for resolving the problems enumerated in 8.14.1.1.

8.14.2. VERIFICATION AND CORRECTION OF DEVICES' CALIBRATION.

As to the method of calculation of devices' calibration factors, all the lists may be divided into 2 series.

The first series include all the lists for which the dosimetric teams calculated the calibration factors proceed from the results of measurement with corresponding devices of standard calibration sources of I-131. The results of calculation of factors were noted on the title page of the list. Furtherly, we shall call such factors determined for each separate list "list-specified factors". These series include all the lists containing spectrometric measurements (310 lists lists performed with devices of 12 types), and a minor part of lists with non spectrometric measurements made with SRP-68-01 type devices (55 lists).

The second series of devices include the lists for which dosimetric teams used a unique calibration factor for all the devices of the same type, which was obtained by averaging the results of calibration of several devices.

These series include the main part (93%) of lists with measurements made with non spectrometric devices. These are, first of all, measurements made using SRP-68-01 devices, and an insignificant number (10 lists, 227 measurements) made with DP-5A and PRL devices. For the devices of SRP-68-01 type, the averaged calibration coefficient was taken as equal to $6.25*10^{-3}$ $h*mR^{-1}*mCi$, for DP-5A $23*10^{-3}$ $h*mR^{-1}*mCi$. (For measurements made using PRL type devices, the calibration factor was not given because the results of measurements were expressed in activity units).

An analysis of the whole of lists showed that both for the first and the second series there are possibilities for correction of calibration factors.

8.14.2.1. Correction of devices' calibration factors by using all calibration measurements of each list.

From 365 lists of the first series, 300 lists together with calibration factors also have all the data necessary for verifying the correctness of their calculation: activity and date of preparation of the calibration source (for 63 lists the time of preparation of the source is also indicated), readings of the device when measuring calibration source. This allowed to perform this verification.

An analysis of lists showed that there were two sources of roughening of results of calculation of devices' calibration factors, which may be eliminated:

1) for calculating a calibration factor, as a rule, only the first measurement of control source in the list was taken into consideration, the other measurements being disregarded;
2) the time t between preparation of the control source and its measurement was taken in whole days (24 hours) in spite of the fact that the current notes in a number of lists allow to establish this time accurate to an hour (the hour of preparation of the source and the hour of measurement are indicated).

The largest contribution to the roughening of the calibration factor is made by the first source. Its contribution is determined by the fact that the counting from the calibration source, being reduced to a unit of activity of the source, is constantly changing in the time. So, for all couples of measurements distributed in the time for one hour, a change in the counting velocity more than by 5 % was observed in 22% of cases, including changes by more than 10% noted in 6% of cases.

There are at least three factors which determine such fluctuations in counting:

a) change in physico-electric characteristics (heating of device, fluctuation of supply voltage, change in output parameters of electric circuits of device);
b) inaccurate recurrence of the geometric configuration of the system "source-detector";
c) statistical fluctuations of radioactive decay rate.

In order to minimize the impact of all the above factors, the calibration factor was calculated for each measurement of the calibration source in a given list; the total factor for the list was calculated as the arithmetic mean of all the values obtained. In calculations one took into account not only the day but also the hour of preparation of the calibration source, as well as the day and hour of measurement of its activity (this allowed to eliminate the error due to the source decay during the day). In case the hour of preparation of the source was unknown, one considered that it

was prepared at 8.00 a.m. of the corresponding day (we proceeded from the fact that measurements usually began at 9.00 a.m., and in 28 lists at 8.00 a.m.).

From 365 lists having an individual list-specified calibration, calibration factors were specified for 290 lists as described. These lists included 235 lists made using spectrometric devices and 55 lists made with non spectrometric devices. The number of measurements of potential cohort members contained in these lists is given in Tables 8.14.5, 8.14.6. For 75 lists (all of them were made using spectrometric devices) data necessary for correction were missing.

For lists with recalculated calibration factors, a comparison was made between the factors obtained and formerly used factors. In case of important (20%) discrepancies between them, an analysis of causes of such a divergence was performed. The results of the analysis and the decisions taken are presented in Table 8.14.3.

8.14.2.2. Use of a calibration factor mean for a device (device-specific), instead of a calibration factor mean for a type of devices (SRP-68-01 devices).

Fig. 8.14.1 shows list-specified calibration factors for lists with non spectrometric measurements (SRP-68-01 devices). One may see from the figure that counting efficiency for different devices considerably differs, and use of a calibration factor unique for all SRP-68-01 devices is not advisable. It has been decided, where it is possible, to replace the calibration factor mean for all SRP-68-01 devices by a factor mean for a concrete device (device-specific factor).

8.14.2.3. Calculation of list-specified calibration factors for lists with possibility of confirmation of the correctness of the values obtained.

When reviewing the primary records, it has been found lists with results of measurement of control sources for which calculation of calibration factors was not performed. Furtherly, we shall call such lists "lists with unused calibration". There are two possible answers to the question why the dosimetric teams did not use these data for calculating calibration factors:

1) in the process of measurements of calibration sources, some requirements to measurements may have not been fulfilled, and the dosimetric teams considered their results as doubtful;
2) in order to simplify the calculations, it was considered as sufficient to use a factor mean for all SRP-68-01 devices.

For devices which formerly had list-specified calibration factors, one may try to clear up which of these explanations is more true. With this purpose, the factors calculated for lists with unused calibration were compared with existing list-specified factors for devices having the same Numbers.

Fig. 8.4.1. gives the results of this comparison. Table 8.14.4 gives the serial Numbers of corresponding devices, as well as the mean values of formerly existing factors and of factors calculated for lists with unused calibration. One may see from data given on Figure 8.14.1 and in Table 8.14.4 that retrospectively restored factors agree with those formerly existing. Serial N 59 device (N 2 on Fig. 8.14.1) is an exception to the rule; its ratio of mean value of calibration factors to the mean value of additionally calculated factors makes 1.65. The same device is also characterized by a significantly understated counting efficiency of gamma quanta. Apparently, this may reflect some deflections in the functioning of this device from its mode of operation. It should

be noted that the factors which were retrospectively restored for this device point out, though not so obviously, an understated counting efficiency of this device.

As a whole, the comparison between formerly used calibration factors and retrospectively restored factors allows to conclude about the equivalence of all measurements of calibration sources for the devices in question. Such a conclusion allows:

a) to use retrospectively restored factors for calculation of thyroid activities in corresponding lists;
b) to use additionally calculated factors for specifying mean device-specific factors for each of devices.

The number of lists for which a list-specified and device-specific correction of calibration factors may be performed (i.e. replacement of a calibration factor mean for all SRP-68-01 devices by a factor mean for a concrete device or by a list-specified factor) is given in Table 8.14.4; the number of measurements contained in these lists (including the number of measurements of potential cohort members) is given in Table 8.14.5.

8.14.2.4. Recalculation of a factor mean for SRP-68-01 devices taking into account correction of device-specific factors.

Even after reviewing primary data, a list-specified or at least a device-specific calibration factor may not be available for all the measurements. For a part of them, a factor mean for all SRP-68-01 devices is still to be used as before.

Addition to 55 lists with formerly existing list-specified calibration factors, of 77 additional lists in which these factors were calculated according to the information on unused calibration, allowed to specify to a considerable extent not only the factors mean for each device, but also the factor mean for all SRP-68-01 devices.

In order to calculate the calibration factor mean for all SRP-68-01 devices, we have used corrected device-specific factors of 12 devices. The data from serial N 59 device have not been used, since as to its efficiency of gamma quanta registration it significantly differed from other devices. Corrected device-specific factors are shown on Fig. 8.14.2., as well as the factor mean for all SRP-68-01 calculated on their basis and equal to $5.29*10^{-3}$ $h*mR^{-1}*mCi$, and the mean factor, formerly used by dosimetric teams, equal to $6.25*10^{-3}$ $h*mR^{-1}*mCi$.

8.14.2.5. Analysis of list-specified calibration factors for lists with impossibility of confirmation of the correctness of the calculated values.

A comparison between calibration factors retrospectively restored according to primary records and formerly existing factors was found to be possible for 9 devices. However, it has been found 139 more lists performed with 14 devices for which calibration factors may also be calculated. Calculation of such factors requires some caution because we have not the possibility to confirm their trustworthiness. An attempt has been made of indirect estimate of the trustworthiness of these factors (let us call them list-specified factors of non calibrated devices) by means of their comparison with a file of factors of calibrated devices (Fig. 8.14.3).

One may see from data given on Fig. 8.14.3 that all 139 list-specified factors of non calibrated devices are below the mean factor which we have formerly calculated for SRP-68-01

devices. At present, we have no answer to the question why the dosimetric teams did not use calibrations' data for these lists. Since these data may not be confirmed by comparison with the calibration factors which were formerly used by dosimetric teams, the question of use of list-specified factors of non calibrated devices is to be cleared up.

8.14.2.6. Results of verification and correction of calibration of dosimetric devices

The main results of the work described in Milestone 8.14.2 are (Table 8.14.6, 8.14.7) the following:

A. For measurements of thyroid activity of potential cohort members made with spectrometric devices, calibration factors of devices have been corrected for 21 763 measurements.
B. For measurements of thyroid activity made with non spectrometric devices, for 8165 measurements the calibration factor mean for SRP-68-01 may be replaced by a more accurate list-specified factor; for 3481 measurements the formerly used list-specified factors have been corrected.
C. For measurements of thyroid activity made with non spectrometric devices, the two-level scheme of use of calibration factors:
   1) a list-specified factor, and if it is missing -
   2) a factor mean for all SRP-68-01,

may be replaced by a three-level scheme:

1) a list-specified factor, and if it is missing -
2) a factor mean for a concrete device, and if it is found to be impossible to calculate it -
3) a factor mean for all SRP-68-01.

Device-specific factors were calculated for 13 devices of SRP-68-01 type; for 12408 measurements the factor mean for all SRP-68-01 may be replaced by a device-specific factor.

D. On the basis of calculated device-specific calibration factors, the mean factor for SRP-68-01 devices has been corrected. This factor may be used in order to specify thyroid activity for 38112 measurements of potential cohort members.

TABLE 8.14.1 - Characteristics and spatial distribution of operation places of dosimetric teams

NN	Area of measurements	Period of measurements	Number of persons measured	Number of lists	Number of lists with dosimetric team's code	Number of lists with dosimetrist's surname	Number of codes	List of codes
1	Vinnytsya obl.	May 26 - May 29	2037	21	21	9	4	?-3; ?-4; ?-6; ?-13;
2	Donetsk obl.	May 30 - May 31	583	8	0	1	0	
3	Zhytomyr obl.	May 16 - Jun 30	48799	389	303	233	10	?-0; ?-1; ?-2; ?-3; ?-4; ?-5; ?-7; ?-8; ?-9; ?-10;
4	Zaporizhya obl.	Jun 6 - Jun 25	396	9	1	0	1	???;
5	Kyiv obl.	May 8 - May 31	7149	64	7	11	1	?-3;
6	Crimea (Republic)	May 16 - Jun 6	12084	99	78	40	8	??-1; ??-2; ??-3; ??-4; ??-6; ??-7; ??-9; ??-11;
7	Lviv obl.	May 29 - May 31	4249	14	14	14	4	??-1; ??-2; ??-2?; ??-3;
8	Odesa obl.	May 17 - Jun 11	17909	166	166	136	16	o-1; o-2; o-3; o-4; o-5; o-6; o-7; o-8; o-9; o-10; o-11; o-12; o-14; o-17; o-18; o-19;

9	Rivne obl.	May 27 - Jun 4	1847	9	0	1	0	
10	Sumy obl.	May 27 - May 31	1969	21	1	0	1	?-16;
11	Ternopil obl.	May 29 - May 29	209	1	1	0	1	?-1;
12	Khmelnytsky obl.	May 24 - Jun 4	3816	30	30	11	1	??-1;
13	Chernihiv obl.	May 17 - Jun 27	47110	209	63	2	10	?-1; ?-3; ?-7; ?-10; ?-11; ?-12; ?-13; ?-14; ?-15; ?-16;
14	Ciity of Kyiv	Apr 30 - Jun 17	1240	46	0	12	1	??-1;

TABLE 8.14.2 - Distribution of information on serial Numbers according to types of devices

	Type of device	Number of lists with measure ments made with the correspon ding device	Number of lists having the device's serial Number	% of lists having the device's serial Number	Number of devices with indication of serial Number
1	GAMMA	6	6	100.00	1
2	GTRM-01C	104	104	100.00	6
3	DP-5A	7	7	100.00	1
4	DSU 2-1	18	18	100.00	3
5	DSU-68	25	15	60.00	2
6	NK-150	50	32	64.00	3
7	NK-350	73	59	80.82	6
8	PRL	3	0	0.00	0
9	SRP-68-01	767	693	90.35	66
10	UR 1-1	13	13	100.00	1
11	UR 1-3	19	19	100.00	1
12	UR 3-2	2	2	100.00	1

TABLE 8.14.3 - Causes of discrepancies between recalculated calibration factors and formerly used factors

Device	Device's serial Number	File	List	Formerly used calibration factor	Recalculated calibration factor	Cause of discrepancy between calibration factors	Decision taken
1	2	3	4	5	6	7	8
GTRM-01C	94	39	924	0,290	0,1348	Calculation of calibtration factor was performed not by dosimetric team's members (another pencil and hand); an error was made in calculations	To use a recalculated calibration factor
GTRM-01C	94	39	922	0,420	0,1042	Calculation of calibtration factor was performed not by dosimetric team's members (another pencil and hand); an error was made in calculations	To use a recalculated calibration factor
GTRM-01C	87	51	333	0,000104	0,0003400	Calibration was carried out after two different sources; there is a doubt as to the correctness of this calibration	To use the factor of the same device calculated on the same day, here, and by the same team (list N 337)
DSU-68	-	60	494,2	0,000266	0,0003436	Device's calibration efficiency monotonously decreased during the day; a factor	To use calibration factors calculated for each of the lists

						averaged for several lists filled in on the same day, was formerly used	

1	2	3	4	5	6	7	8
DSU-68	-	60	494,3	0,000266	0,0004056	Device's calibration efficiency monotonously decreased during the day; a factor averaged for several lists filled in on the same day, was formerly used	To use calibration factors calculated for each of the lists
DSU-68	-	60	494,4	0,000266	0,0004441	Device's calibration efficiency monotonously decreased during the day; a factor averaged for several lists filled in on the same day, was formerly used	To use calibration factors calculated for each of the lists
DSU-68	-	61	495,2	0,000297	0,0003973	Device's calibration efficiency monotonously decreased during the day; a factor averaged for several lists filled in on the same day, was formerly used	To use calibration factors calculated for each of the lists
DSU-68	-	61	495,3	0,000297	0,0004449	Device's calibration efficiency monotonously decreased during the day; a factor averaged for several lists filled in on the same day, was formerly used	To use calibration factors calculated for each of the lists
NK-	71070	65	655	0,000634	0,001100	Time of measurement of the source and of thyroid activity	To return from the factor averaged for the day to

150						are probably different	the factor calculated by the dosimetric team

1	2	3	4	5	6	7	8
NK-150	71077	65	501	0,000699	0,0005500	Time of measurement of the source and of thyroid activity are probably different	To return from the factor averaged for the day to the factor calculated by the dosimetric team
NK-150	71077	66	503	0,000974	0,0005500	Time of measurement of the source and of thyroid activity are probably different	To return from the factor averaged for the day to the factor calculated by the dosimetric team
NK-150	71077	66	631	0,000580	0,0002970	Time of measurement of the source and of thyroid activity are probably different	To return from the factor averaged for the day to the factor calculated by the dosimetric team
NK-150	71077	67	507	0,000744	0,0005500	Time of measurement of the source and of thyroid activity are probably different	To return from the factor averaged for the day to the factor calculated by the dosimetric team
NK-150	71070	70	653	0,000619	0,001100	Time of measurement of the source and of thyroid activity are probably different	To return from the factor averaged for the day to the factor calculated by the dosimetric team
UR 1-3	912001	78	586	0,00135	0,001800	The calibration factor was averaged for 5 days of measurements	To use a recalculated calibration factor
UR 1-3	912001	81	581	0,00135	0,001704	The calibration factor was averaged for 5 days of	To use a recalculated calibration factor

						measurements	
NK-350	76028	84	89	0,000139	0,00001360	There was possibly an error in the order of factor in the calculations of the dosimetric team; this conclusion is made from an analysis of mean activities	To use a recalculated calibration factor

1	2	3	4	5	6	7	8
NK-350	76028	86	84	0,000138	0,00001300	There was possibly an error in the order of factor in the calculations of the dosimetric team; this conclusion is made from an analysis of mean activities	To use a recalculated calibration factor
UR 1-1	10242	90	352,01	0,0000190	0,00002470	Represents a sublist of the list 352, which has been completed 2 days after; formerly, the calibration factor calculated for the list 352 was used	To use a recalculated calibration factor
NK-350	76028	90	648	0,000117	0,00002160	There was possibly an error in the order of factor in the calculations of the dosimetric team; this conclusion is made from an analysis of mean activities	To use a recalculated calibration factor
SRP-68-01	59	91	786	0,01056	0,01418	Formerly, when calculating the factor, background was not subtracted from device's reading	To use a recalculated calibration factor
SRP-68-01	59	91	806	0,01276	0,01603	Formerly, when calculating the factor, background was not subtracted from device's	To use a recalculated calibration factor

						reading	
SRP-68-01	59	91	783	0,01663	0,02156	Formerly, when calculating the factor, background was not subtracted from device's reading	To use a recalculated calibration factor
SRP-68-01	59	91	779	0,01293	0,01738	Formerly, when calculating the factor, background was not subtracted from device's reading	To use a recalculated calibration factor
SRP-68-01	59	91	778	0,01138	0,01795	Formerly, when calculating the factor, background was not subtracted from device's reading	To use a recalculated calibration factor
ñðï-68-01	59	92	785	0,01086	0,01933	Formerly, when calculating the factor, background was not subtracted from device's reading	To use a recalculated calibration factor
SRP-68-01	59	92	782	0,01124	0,02055	Formerly, when calculating the factor, background was not subtracted from device's reading	To use a recalculated calibration factor
SRP-68-01	1075	138	22	0,006802	0,01072	The calibration factor was averaged for 6 lists made during the day	To use a recalculated calibration factor
1	2	3	4	5	6	7	8
SRP-68-01	149	138	18	0,004888	0,007138	The recalculated factor is very close to the factor	To use a recalculated calibration factor

						calculated by the dosimetric team; the source of error, when recalculating the factor in 1993, remains unclear	
SRP-68-01	1075	138	20	0,006802	0,009110	The calibration factor was averaged for 6 lists made during the day	To use a recalculated calibration factor
SRP-68-01	1075	138	20,1	0,006802	0,009110	The calibration factor was averaged for 6 lists made during the day	To use a recalculated calibration factor
SRP-68-01	1075	138	21	0,006802	0,008897	The calibration factor was averaged for 6 lists made during the day	To use a recalculated calibration factor

TABLE 8.14.4 Mean values of calibration factors for SRP-68-01 type devices

Conditi o-nal device's Numbe r	Device's serial Number	Number of lists with list-specified calibration factors calculated by dosimetric teams	Number of lists with retrospective ly restored calibration factors	Total number of lists after which the mean calibration factor was calculated for the correspondin g device	Total number of lists made with the correspondin g device	Mean value of formerly existing list-specified calibration factors for the correspondi ng device	Mean value of retrospectivel y restored calibration factors	Total mean device-specific calibration factor
1	43	3	2	5	5	2.10	2.29	2.18
2	59	8	2	10	10	17.98	10.93	16.57
3	90	1	4	5	6	4.75	4.89	4.86
4	149	2	-	2	37	6.83	-	6.83
5	268	3	-	3	98	6.31	-	6.31
6	863	6	5	11	11	5.35	5.40	5.37
7	1075	6	-	6	23	8.87	-	8.87
8	1272	4	-	4	4	8.41	-	8.41
9	1665	2	13	15	16	4.40	3.18	3.34
10	1670	1	14	15	15	4.39	4.66	4.64

11	1677	3	10	13	13	4.50	3.26	3.55
12	1748	10	14	24	24	4.46	3.46	3.88
13	2085	6	9	15	15	5.08	5.26	5.19

TABLE 8.4.5 - Number of measurements for which a correction (list-specified and device-specific) of calibration factors was made

Device's Number	Number of measurements with list-specified individual calibration factors	Number of measurements with additionally calculated list-specified individual calibration factor	Number of measurements for which the mean calibration factor for the type of device may be replaced by a device-specific individual factor	Total number of measurements made by the device
43	600	428		1028
1665	164	1644	69	1877
1677	187	1091		1278
1748	973	1631		2604
1670	257	1509		1766
90	1	518	168	687
2085	659	1203		1862

863	726	758		1484
268	440		14033	14473
149	274		4800	5074
1272	674			674
1075	335		3508	3843
59	766	180		946
Total number of measurements made by 13 devices	6056	8962	22578	37596
including measurements of potential cohort members	3481	8165	12408	24054

TABLE 8.14.6 - Results of verification of calibration of spectrometric devices for measurements of thyroid activity in potential cohort members

Series of measurements of potential cohort members	Number of measurements	In % of the total number of spectrometric measurements
All measurements made with spectrometric devices	39822	100.00
Measurements for which list-specified calibration factor was specified	21697	54.48
Measurements for which the calibration factor calculated by dosimetric teams is to be used	18125	45.52

TABLE 8.14.7 - Results of verification of calibration of non spectrometric devices for measurements of thyroid activity in potential cohort members.

Series of measurements of potential cohort members	Number of measurements	In % of the total number of non spectrometric

		measurements
All measurements made with non spectrometric devices	62176	100.00
Including measurements made with SRP-60-01 devices	62003	99.72
Measurements with formerly used list-specified individual calibration factors	3481	5.60
Measurements for which list-specified individual calibration factors were calculated	8165	13.13
Measurements for which device-specific individual calibration factors were calculated	12408	19.96
Total number of measurements for which the calibration factor averaged for a type of device may be replaced by an individual (list-specified or device-specific) factor	20573	33.09
Measurements for which the calibration factor averaged for all SRP-68-01 devices is still to be used	38122	61.31

Fig. 8.14.1 - Comparison between list-specified calibration factors for SRP-68-01 devices (crosses) and retrospectively restored factors of lists with unused calibration for the same devices (circles). The red line shows the value of the calculated calibration factor mean for all SRP-68-0; the green line shows the formerly used calibration factor mean for all SRP-68-01.

Fig. 8.14.2 - Device-specific values of calibration factors for SRP-68-01 devices. The red line shows the value of the calibration factor, calculated on their basis (except the device N 2), mean for all SRP-68-01; the green line shows the formerly used calibration factor mean for all SRP-68-01.

Fig. 8.14.3 - Comparison of list-specified calibration factors of SRP-68-01 devices for the lists for which it was impossible to confirm the correctness of information on calibration (circles; devices NN 14 to 27), and for the rest of lists (crosses; devices NN 1 to 13). The horizontal line shows the calculated calibration factor mean for SRP-68-01.

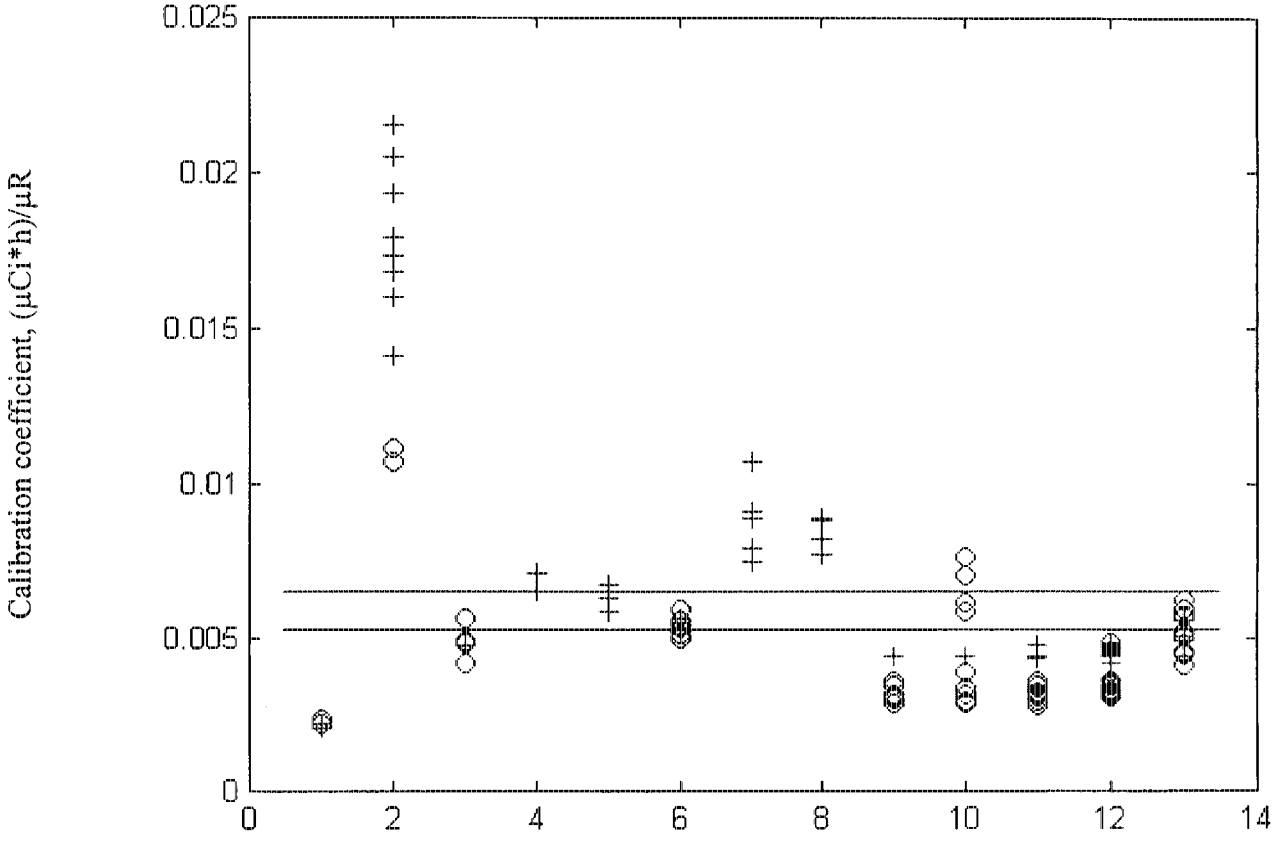

Fig. 8.14.1 - Comparison between list-specified calibration factors for SRP-68-01 devices (crosses) and retrospectively restored factors of lists with unused calibration for the same devices (circles). The red line shows the value of the calculated calibration factor mean for all SRP-68-0; the green line shows the formerly used calibration factor mean for all SRP-68-01.

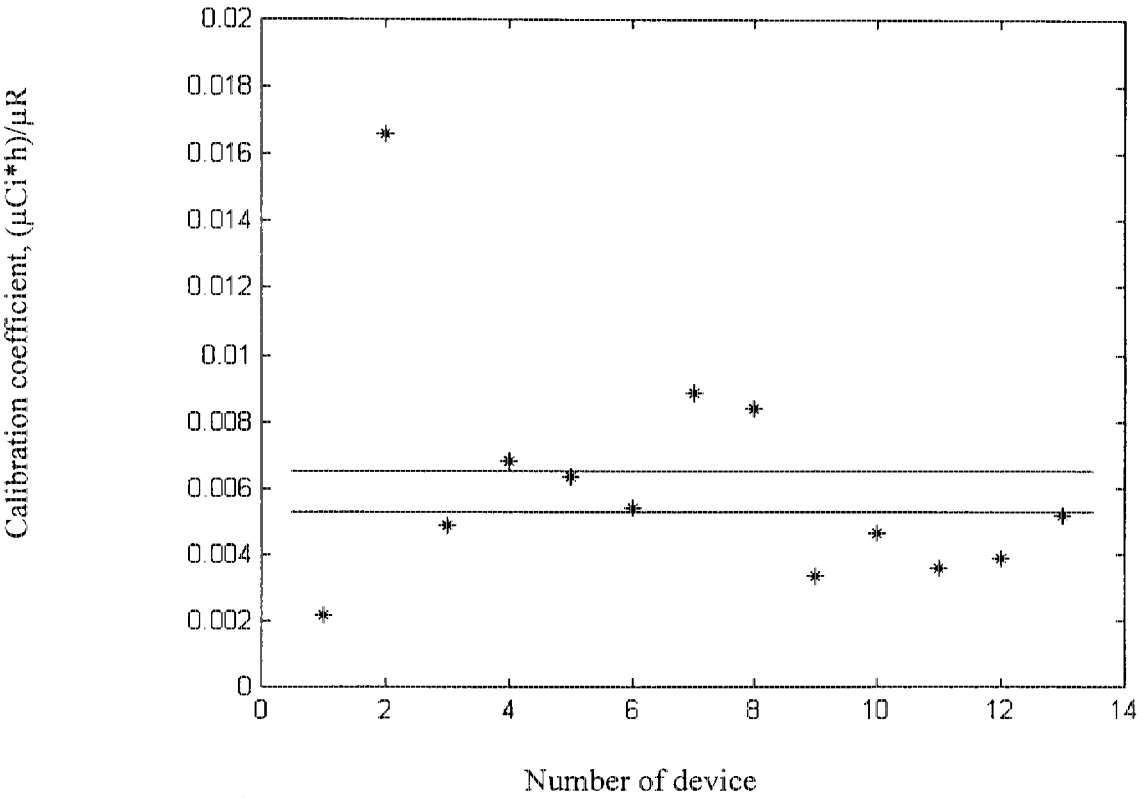

Fig. 8.14.2 - Device-specific values of calibration factors for SRP-68-01 devices. The red line shows the value of the calibration factor, calculated on their basis (except the device N 2), mean for all SRP-68-01; the green line shows the formerly used calibration factor mean for all SRP-68-01.

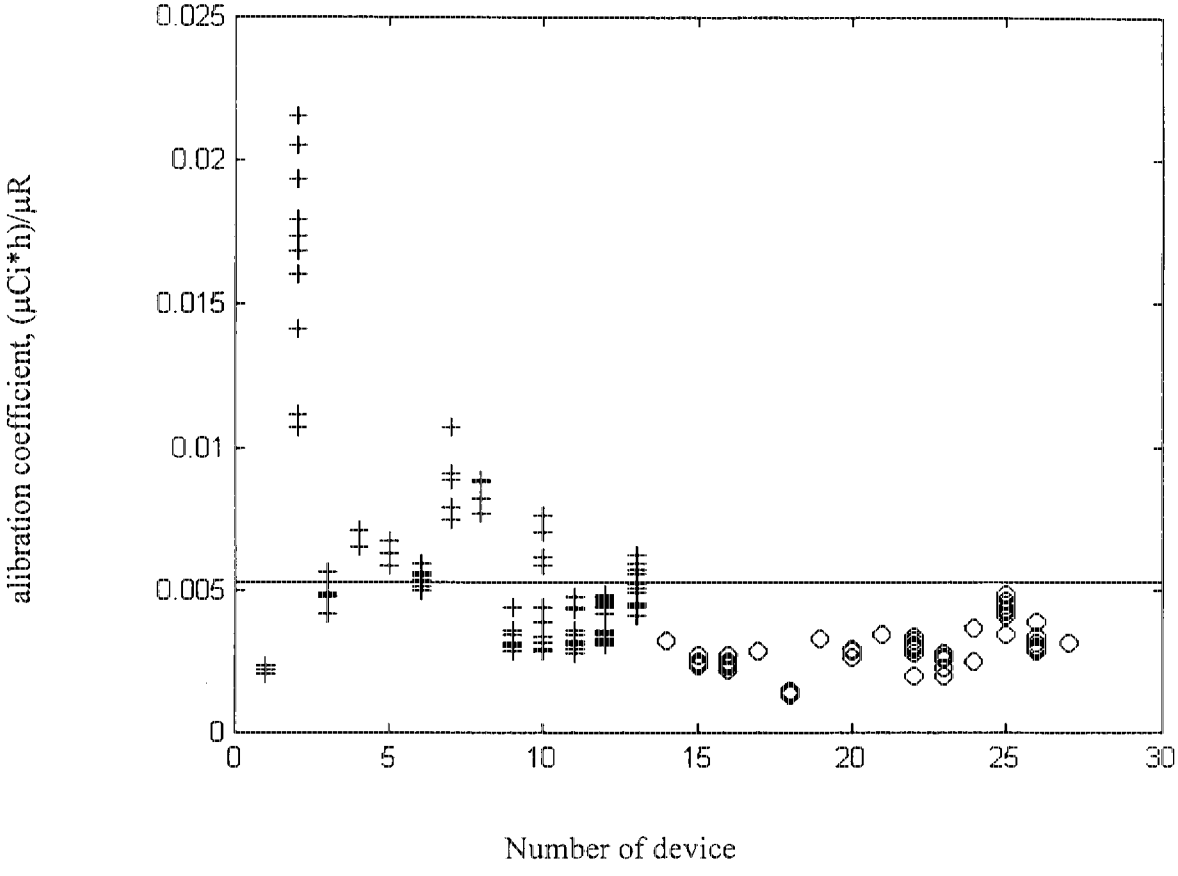

Fig. 8.14.3 - Comparison of list-specified calibration factors of SRP-68-01 devices for the lists for which it was impossible to confirm the correctness of information on calibration (circles; devices NN 14 to 27), and for the rest of lists (crosses; devices NN 1 to 13). The horizontal line shows the calculated calibration factor mean for SRP-68-01.

UKRAINIAN - AMERICAN SCIENTIFIC PROJECT ON THE STUDY OF CANCER AND OTHER THYROID DISEASES IN UKRAINE AS A CONSEQUENCE OF THE CHORNOBYL ACCIDENT

Tasks for the 1th quarter of the 3rd year (June - August, 1998)

1	TASK	man*month
1	**The management and administration**	
1.1	To complete equipping of the Data Coordinating Center (software and hardware) and Project Office (fax-machine, copyers).	0.5
1.7	To organize in June,1998 a joint meeting of the Leaders of the Ministry of Public Health and Administration of the Ukr.-Am. Thyroid Project with participation of the main executors of the Project, on the basis of the Chernihiv Oblast Dispensary of Radiation Protection of the Population.	1.0
1.8	To prepare all necessary custom documentation for the equipment received in the framework of the Project, make inventory of this equipment.	2.0
1.10	**To perform preparatory work in order of screening of the cohort members who reside in Kozelets raion of Chernihiv oblast.**	2.0
2	**The establishment of the cohort**	
2.7	To continue entering the data from paper carriers, which have been obtained in controlled raions as a result of computer and manual search, into the database of the Project.	4.0
2.8	To make a computer analysis of verified data, which have been obtained on magnetic carrier, on the cohort members who reside in Ovruch raion of Zhytomyr oblast.	1.0
3	**Invite the subjects for endocrinologic screening**	
3.1	To ñîntinue invitations by the telephone of the cohort members currently living in Kyiv which were resettled from Chornobyl and Prypyat.	1.0
3.2	To obtain consent to take part in screening from cohort members who reside in the town Ostior, Kozelets raion, Chernihiv oblast.	1.0
3.3	To publish in the Kozelets local newspaper an article clearing up the purposes of the screening of the population of Ivankiv raion in the framework of the Ukr.-Am. Project.	0.5
3.4	To give a broadcast talk on the local radio of Kozelets raion in order to inform the population about purposes and tasks of the Ukr.-Am. Thyroid Project.	0.5
3.5	On the basis of the information received on consent to take part in the screening, to make a schedule of screening of the population of the town Ostior, Kozelets raion, and Kyiv, resettled from Chornobyl and Prypyat.	1.0
4	**The endocrinologic examination of the subjects**	
4.3	To continue screening of cohort members who have been	10.0

	resettled from Chornobyl and Prypyat to Kyiv.	
4.4	To begin screening of cohort members who reside in the town Ostior, Kozelets raion, Chernihiv oblast.	10.0
5	**The operation of the Central Laboratory**	
5.2	To perform all the laboratory tests in the process of screening.	7.0
6	**The operation of Data Coordinating Center**	
6.1	To receive equipment according to the Protocol. Installation of the local network and software.	2.0
6.2	Installation, studying and management of the database InterBase server.	2.0
6.3	Recompilation of available databases into InterBase format.	1.0
6.13	To work out a complex of programs for the Pathology Group operation.	2.0
7	**Pathology support for diagnosis of various forms of thyroid pathology.**	
7.1	Continue collecting and pathological examination of morphologic material from all patients born in 1968 and later from cohort oblasts and having been operated at the Institute of Endocrinology for different thyroid diagnoses.	6.0
7.2	Preparation of additional histological specimens for morphologic data bank of the Ukr.-Am. Project from patients including in the cohort.	1.0
7.3	Ensure intraoperational diagnosis, histological processing and pathomorphologic analysis of specimens received from patients selected for surgery after screening. Preparation of additional histological specimens for morphologic data bank of the Ukr.-Am. Project.	1.0
7.4	Fill in the Pathology Form for the patients with different types of thyroid pathology who were operated and included in the cohort. Put down these data on the computer and give them to DCC (after receipt of computer)	1.0
8	**Dosimetry support of the Project**	
8.15	Verification of thyroid measurements. Distribution of the number of dose estimates according to degree of reliability. List of problems to be solved.	12.0
8.7	To continue the support of the questionnaire DB. Questioning, input and computer support of questionnaires' information.	12.0
8.16.	Contribution to the thyroid dose of the intake of radiocesium: methodology.	5.0
8.17.	Contribution to the thyroid dose of the external irradiation from deposited radionuclides: methodology.	5.0