HEALTH CONDITION OF PEOPLE BEING IN CONTACT WITH RADIOACTIVE SUBSTANCES IN HANOI AND FIRST STEPS IN THE RESEARCH OF MEDICINES WITH RADIATION ELIMINATION AND PROTECTION EFFECTS DURING THE PREIOD FROM 1986 TO 1990

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Abstract. During recent five years having been keeping a check on health of officials and staff made contact with the radioactive are around Hanoi indicated the common health of people has been decreased. The people get mostly the disease such as nervous debility, breathe, colitis,... incidence of diseases increases according to the service seniority, especially after five years connecting with radioactive elements and diseases occurred mainly to those who contacted directly with radioactive elements an early decrease of white cells especially, Lympho white cells. The more service seniority is long the more white cells decrease is a good biological index to evaluate the degree of fallout. There is a stimulating phenomenon of erythrocytosis in initial years and of a chear hemoglobin erythropemic persons made contact with the radioactive elements of more than 10 years. Erythrocyte has characteristic in common is bigger than normal one 011 medicinal, that herbs have been researched, affected on radioactive elimination or protection. Two medicinal herbs have effect on radioactive elimination are Na-anginat and china tree.

1. Introduction

In the development of our industry, more and more different branches and units use radioactive substances with the purposes of researching, exploring minerals, diagnosing and treating diseases, preventing agricultural produce etc. For the last 30 years, Vietnam step by step has begun exploring and exploiting valuable radioactive ores and the number of people working with radioactive substances has been increasing day by day. The environment issue and the problem with man in our country, as well as in the common background in the world is a global hot issue. Research into the effects of radioactive substances, especially in case with small dosages, for a long period of time and with accumulative character on the human health is becoming an urgent issue. At the same time, it is necessary to find medicines that can eliminate radiation and protect people from radiation,

especially the medicines prepared from domestic materials. The subject 52Đ 0503 in the government-level program 52Đ on "Natural resources and environment protection" has begun a study into this issue.

2. Subjects and methods of the study

2.1 Subject

Including the stuff number of 244 in the exploiting and refining valuable radioactive ores base in Phung and Nghia Do; during the period of time from 1986 to 1990; at the age of 18-41. They are divided into two groups:

Group A: including people being in direct contact: the staff in the furnace, in the department of radiochemistry, ore selecting department.

Group B: including people being in indirect contact: the staff in the administration department, in service units.

These groups are subdivided into small groups according to their service seniority from 1 to 5 years, 6 to 10 years and more than 10 years.

Table 1

Service seniority	A (Direct contact)	B (Indirect contact)
1 - 5 years	10	25
6 - 10 years	10	35
More than 10 years	42	122
Total	62	182

2.2 Methods

2.2.1 Clinical examination: Annul all-sided examination according to the form of clinical record on occupational disease; clinical record for each year is filed.

2.2.2 Blood test

- Red blood cell counting according to Macano;
- Blood pigment quantification according to Sahli;
- White blood cell counting according to Hayem;
- White blood cell formularization;
- Glomerule counting according to Fiessly;
- Dying net red blood cells with light-blue Crezyl;
- Hematocrit verification by nioro;

- Red blood cell constant verification: the average volume of a red blood cell; the average capacity for blood pigment per red blood cell, the average concentration of the blood pigment in a red blood cell.

2.2.3 Function detection

Electrocardiogram record by a Chinese one-channel machine.

3. Materials and methods in the research of medicines with radiation elimination and protection effects

3.1 Medicinal herbs researched

The names of herbs are identified; samples are picked up according to the local time.

- The main active biological group of the herb is preliminary researched;
- An appropriate medicine is extracted or prepared;
- Standard medicine: AET (made in Germany)

3.2 Radiation elimination

Rabbits are given 2.5ml of the solution of Sr^{85}; The activity level of the radioactive substance is 50 micro Curi per 2.5ml. The rabbits are given the solution using curved needle. Next the rabbits are given medicine to eliminate radioactive substances; samples of excrement and urine are taken to measure the level of radioactive substances being eliminated. Finally, samples of the viscera are taken to measure the level of radiation left.

3.3 Observing the mice remained alive

- White thoroughbred house-mice of the age of eight weeks and average weight of 18-22 gram are used.
- Radiation exposure: 600-700 rad from Co^{60} in Hanoi hospital K. The mice are given radiation-protecting medicines every day and the number remained alive is observed after 30 days.

4. Results and conclusions

4.1 Some illnesses often met in people being in contact with radioactive substances for a long time (Table 2)

4.1.1 Nerve asthenia: is the most often met illness. Diagnose is given based mainly on clinical symptoms (insomnia, memory decrease, temper changes); for

some patients electro-encephalogram is carried out. According to the Table 2: the percentage of people suffering from nerve asthenia in Group A (direct contact) is considerably higher than that in Group B (indirect contact) with $p<0.05$ and the percentage of cases of the illness increases as the year of service seniority increases. When the service seniority is more than 10 years, considerable difference is observed with $p<0.05$. According to Hug, the sympathetic nerve system is very sensitive to ionizing radiation. Its reaction tends to be inhibitory and hypotonia. Nerve asthenia and neurovegetative disorder are the early symptoms (stage 1) of chronic radiation illness (Werner: 1985; Chomrov: 1985).

Disease	1-5 years		6-10 years		>10 years	
	Direct contact n=10	Indirect contact n=25	Direct contact n=10	Indirect contact n=35	Direct contact n=42	Indirect contact n=122
Stomach and intestine illnesses	1 (10%)	5 (20%)	3 (30%)	8 (23%)	12 (28%)	19 (16%)
Nerve asthenia	3 (30%)	3 (12%)	4 (40%)	6 (17%)	19 (45%)	25 (20%)
Anaemia	0	0	2 (20%)	3 (8%)	15 (36%)	15 (12%)
Bronchitis, pharyngitis	1 (10%)	0	5 (50%)	4 (11%)	14 (33%)	10 (12%)
Pulse less than 60 times/sec.	1 (10%)	1 (4%)	2 (20%)	2 (6%)	10 (24%)	6 (5%)
Blood pressure less than 100mmHg	0	0	2 (20%)	3 (8%)	12 (28%)	6 (5%)

4.1.2 Bronchitis, pharyngitis are often met diseases

In the group of people being in direct contact, especially high percentage is met among workers in the furnace and ore selecting. According to the service seniority, the group of people working for 6-10 years have the percentage of cases of illness considerably higher than that of people working for 1-5 years. However, in the group of people working more than 10 years the cases of illness decrease considerably. Above-mentioned illnesses with respiratory systems such as bronchitis and pharyngitis are mainly due to ore dust and chemical vapour. Among the group of people being in contact with the radioactive substances for a long period of time (more than 10 years) the percentage of cases of illnesses decreases

maybe because of a better protection (thanks to experience and individual awareness). Among this group we have never met a case of pneumoconiosis.

4.1.3 Illnesses with stomach and intestine are mostly chronic gastritis, duodenitis and colitis. Among cases of gastritis and duodenitis the most often kinds of illnesses are hypoacidification and hyposecretion. Under the influence of ionizing radiation, glands of the stomachare inhibited (due to local disorder of the blood system) and gradually decreases in size.

According to our data, the percentage of cases of illness in the group of people with the service seniority of 6-10 years is considerably higher than that in the group of people working for 1-5 years. However, the difference compared to the group of people working more than 10 years is insignificant.

4.1.4 Anaemia is mostly met among the group of people being in direct contact with the radioactive substances for more than 10 years. The characteristics of the illness is often isochromia and hyperchromia, differing from the main characteristic of the illness in Vietnam - hypochromia (caused by insufficiency of ion, malnutrition). This may be partially caused by the influence of ionizing radiation in two forms: the first one is the direct influence on ARN, AND; the second one is through the influence on the stomach, causing a decrease in gastromucopreine, and then causing a decrease in B12 absorption.

4.1.5 Changes in the cardio-vascular system are mostly slow pulse (less than 60 pulses per minute) and the cases of illness increase as the service seniority increases (Table 2). During the first 5 years the pulse is slow (due to sympathetic power), after 5 years of being in contact with radioactive substances the percentage of people with slow pulse increases considerably, followed by low blood pressure, which may affect the effectiveness of the work.

Other illnesses: skin-disease, diseases with bones and arthroses are less often met.

4.2 Changes in blood (Table 3)

4.2.1 There are 15 cases of people with the number of white blood cells increasing up to more than 9×10^9, mostly among people in their first 10 years of work, especially the group of people with the service seniority of 1-5 years constitutes 30% of the cases. During this period, a slight increase in the growth of spinal cord is observed.

There are 24 cases with the number of white blood cells decreasing to less than 4×10^9/liter. Among this number, there is no case in the group of people working for 1-5 years, one case in the group of people working for 6-10 years. The phenomenon of white blood cell decrease is mainly concentrated in the group of people working for more than 10 years and being in direct contact with the radioactive substances (31%). The number of polynuclear neutrophils and

lymphocytes also decreases noticeably in the group of people being in direct contact for more than 5 years (30%) and for 10 years (36 and 33%).

Table 3

	1-5 years		6-10 years		>10 years	
	TT n=10	GT n=25	TT n=10	GT n=35	TT n=10	GT n=42
White blood cells 9×10^9/liter	3 (30%)	1 (4%)	2 (20%)	2 (6%)	3 (7%)	4 (3%)
4×10^9/liter			1 (10%)		13 (31%)	10 (8%)
N 6×10^9/liter	2 (20%)	1 (4%)	1 (10%)	2 (6%)		3 (2%)
2×10^9/liter			3 (30%)	1 (3%)	15 (36%)	1 (0.8%)
L 3×10^9/liter	3 (30%)	3 (12%)	1 (10%)	1 (3%)	1 (2%)	5 (4%)
1.2×10^9/liter	1 (10%)		3 (30%)		14 (33%)	
Red blood cells 5×10^{12}/liter	4 (40%)	1 (4%)	1 (20%)	5 (14%)		8 (7%)
3.5×10^{12}/liter			1 (10%)		11 (26%)	2 (2%)
HCL 1%	3 (30%)		3 (30%)	2 (6%)		6 (5%)
MCV (3)	105±11	99±8	112±13	101±6	118±20	101±8
MCH (pg)	35±2	31±3	37±2	33±3	37±3	31±4
Blood pigment 150g/liter	3 (3%)	3 (12%)	3 (30%)	3 (20%)	1 (2%)	10 (8%)
100g/liter			1 (10%)		8 (19%)	1 (0.8%)

According to Neumeister (1978), lymphocyte group is one of groups most sensitive to radioactive rays. It is affected early with small dosages, therefore, changes in lymphocytes are often used as a biological indicator to evaluate the level of radiation absorbed. Here we also notice a considerable change, especially in the first 10 years of being in contact with radiation - this change is the phenomenon of

increasing the number of eosinophils (acidophils), which proves the state of radiation allergy.

4.2.2 Changes of red blood cells and blood pigment

During the first 10 years being in contact with radioactive substances, the number of red blood cells and blood pigment increases slightly: the cases of red blood cell > 5×10^{12}/liter make up 40% during the first 5 years and 20% during the next 5 years. The cases of blood pigment > 150 gram/liter make up 30% in people being in direct contact and 12-20% in people being in indirect contact. Net red blood cell also increases slightly together with the red blood cell increase. After ten years being in contact with radioactive substances, a decrease in red blood cells and blood pigment is observed: the cases of insufficiency of red blood cells (<3.5×10^{12}/liter) make up 26% and the cases of insufficiency of blood pigment (<100 gram/liter) make up 19% of the group being in direct contact for more than 10 years. It is necessary to emphasize that the amount of red blood cells decreases more than of blood pigment does and the size of red blood cells is larger than normal, especially in the group being in direct contact. The size of red blood cells also increases according to the service seniority. The average volume of red blood cells during the first 5 years being in contact is 105 ± 11μ^3 (the constant for Vietnamese is 90-100μ^3), during the next five years is 112 ± 13μ^3 and for people being in contact for more than 10 years is 118 ± 20μ^3. The average amount of blood pigment also slightly increases according to the service seniority. Maybe it is due to the direct and indirect effect of radioactive rays on the blood formation process as we have mentioned above.

4.3 Some medicines in Vietnam with radiation elimination and protection effects

4.3.1 *Na alginate:* extracted from Sargassacaae found in Hon Chong, Nha Trang. In 1997 Tran Van Au and his collaborators succeeded in extracting alginic acid, prepared in the form of sodium alginate salt with M of 200,000. In 1979 Lam Xuan Hai and his collaborators carried out an experiment, in which rabbits were given Sr^{85} with the activity level of 50 microcuri/2.5 ml of the NaCl solution 0.9%. Next rabbits were given Na alginate with the dosage of 1 gram alginate/kilogram of rabbit. Then samples were taken to measure the radiation level in waste according to the time stipulating animal destruction; the level of radiation left in liver, spleen and sclerosis.

The results: The group given Na alginate could eliminate 58% of Sr^{85}.

The group in comparison could eliminate only 35% of Sr^{85}.

4.3.2 Hill Burtt Cataplasm: prepared from the bar of Choerpondias axit lares Hill Burtt (belonging to the family Anacardiaceae) which can be found in Northern regions of Vietnam.

In 1973 Nguyen Liem and his collaborators extracted a mixture of cataplasm consisting of many active elements such as 3-Sitosterol, Flavonoit, and Tanin Pyrocatechic. The concentration of Tanin Pyrocatechic is about 30%.

In 1979 Lam Xuan Hai made a study in radiation elimination with the above mentioned method, giving rabbits the cataplasm with the dosage of 1 gram of cataplasm/1 kilogram of rabbit.

The results: The group drinking the cataplasm could eliminate 71% of Sr^{85}.

The group in comparison could reduce only 35% of Sr^{85}.

4.3.3 *Black tea:* Prepared from leaves of the tea plants Camllia Sinensis belonging to the family Theacae. Chemical constituents are as following: Cafein makes up 1.5-5%; vitamin B1, B2, C, Tanin Pyrotechic make up 20%.

In 1980 Nguyen Xuan Phach made a study on 4 groups of white thoroughbred house-mice, each group consists of 500 mice. Phu Tho black tea was used to be injected into peritoneal membrane. Then the results were compared to the results obtained using standard medicines (Ph.D dissertation in Germany observing the number of mice surviving after 30 days).

The results:

A.E.T 200 mg/kg = 300% compared to the group in comparison.

Xystamin 100 mg/kg = 300% compared to the group in comparison.

Black tea 100 mg/kg = 600% compared to the group in comparison.

4.3.4 Astragalus roots

Chemical constituents: Cholin, Betain, acid amine and Saccarosa.

In 1967 Vu Ta Cuc, Nguyen Dat made a study in radiation protection of Astragalus roots and found out that the Astragalus roots could protect from radiation to a certain extent. the ratio of dosage reduction is 1.27.

4.3.5 Day-lily

The scientific name is Hamorocallis Fulval, belonging to the Liliaccac family and can be found in the Northern regions of Vietnam.

Chemical constituents (have not been properly studied) in general contain Flavon, Anthxxyan. In 1967 Radiation Department of The Army Medical Institute made a study into the effect of day-lily on radiation protection and found out that day-lily has a weak effect on radiation protection. The ratio of dosage reduction is 1.1.

4.3.6 *Red multiflorous knootweed*: Roots of Folygonum multiflorum belonging to the Polygonaceac family which can be found in Northern regions of Vietnam were used.

In 1986 Nguyen Liem and collaborators found out that Red multiflorous knootweed contains starch, protein, fats, antraquinon. Besides, it also contains phytosterol, tanin pyrocatechic 6.8% and acid amine. In 1986 Nguyen Xuan Phach and collaborators used red multiflorous knootweed for white house-mice with the dosage of 1 gram/1 kg of mice. The dosage of radiation was 70 rad. Then they obtained the following results:

- The ratio of dosage reduction: AET = 1.3

- The ratio of dosage reduction: Red multiflorous knootweed = 1.4

- In the group of mice which had been given the medicine prepared from red multiflorous knootweed, the number remained alive after 30 days constitutes 40-50%.

- In the group of mice which had been given AET, the number remained alive after 30 days constitutes 35%.

- In the group of mice which had not been given any medicine (the group in comparison), the number remained alive after 30 days constitutes only 15%.

4.3.7 *Green bean*: Green beans from Phaseolus aureus Poxb which belongs to the Papilionaceae-Fabaceae family and can be found anywhere in Vietnam. Besides known chemical constituents, starch, acid amine, in 1986 Nguyen Liem and collaborators found in green beans 3-Sitosterrol, Flavonoit, single sugars, 6 acid amines, 4 vitamins; in 1984 Tran Van Hanh and collaborators made a study on mice with the radiation exposure of 700 rad.

The results:

- In the group of mice eating green beans, the number remained alive after 30 days constitutes 65%.

- In the group of mice in comparison, the number remained alive after 30 days constitutes 25%.

Besides, green bean is found to have good effects during the process of Lymphocyte recovery, helping the immune system in protecting against bad effects of radiative rays.

4.3.8 *Rutin:* Extracted from Spera Japanica which belongs to Papolionaceae family found in the Northern regions of Vietnam.

Flower-buds of Spera contain 6-30% Rutin. In 1987 Le Thi Thuy made a study into the effect of Spera flower-buds upon radiation protection. Mice were given 124 mg of Rutin/1 kg of mice for 30 days. The observed results are:

In the group which had not been given the medicine the number remained alive constitutes 57%.

In the group which had been given the medicine, the number remained alive constitutes 75%.

4.3.9 *Quexetin:* Rutin is obtained from Spera Japanica. Then it is hydrolyzed. The substance obtained is Quexetin with chemical and physical properties identical to those of standard quexetin. In 1987 Nguyen Liem and Le Thi Thuy gave mice quexetin once in two days with the dosage of 124 mg/1 kg of mice. The mice were observed for 30 days.

The results:

- The the group in comparison: the number of mice remained alive constitutes 57%.

- In the group given the medicine: the number of mice remained alive constitutes 75%.

4.3.10 Flavon, Catechin

Extracted from some medical herbs for treatment of burns which contain Tanin Catechic. Tanin is separated using gelatin solution of 10%. The mixture of Cattechin, Flavon is left. Nguyen Liem, Trieu Duy Diet, Le Thi Thuy and collaborators gave mice catechin with the dosage of 124 mg catechin/1 kg of mice for 30 days.

The results:

- In the group in comparison: the number of mice remained alive constitutes 57%.

- In the group given Flavon and Catechin: the number of mice remained alive constitutes 88%.

4.3.11 *AP*: AP is kind of medicine available in Vietnam. In 1984 Nguyen Liem and collaborators made a study and found out that the amount of protein is 18-20%, 10 free acid amines, and vitamins. They prepared then Phylamin.

Tran Van Hanh and his collaborators made a study into the effects against radiation on white thoroughbred house-mice. The mice were given C57.BL6J with the dosage of 1g/ 1kg of mice. The dosage of radiation exposure is 700 rad.

The results:

- In the group which had been given the medicine, the number of mice remained alive after 30 days constitutes 78.6%.

- In the group in comparison, the number remained alive after 30 days constitutes only 28%.

5. Conclusion

- After 5 years of observing the health conditions of workers being in contact with rare radioactive ores around Hanoi we could make conclusion that their health

conditions in general have become worse. The most often met diseases are nerve asthenia, inflammation of the upper respiratory tract, gastritis, duodenitis, chronic colitis, anaemia, and disorder of pulse and blood pressure.

- The rate of illnesses increases according to the service seniority, especially after 5 years being in contact and mostly met in people being in direct contact with radiation.

- The number of white blood cells, especially Lymphocytes decreases early and decreases considerably if the time being in contact is long (the service seniority is high). This serves as good biological indicator to evaluate the level of affection by radioactivity.

- It is observed that the number of red blood cells increases during the first years and then decreases considerably after being in contact for more than 10 years.

- The size of red blood cells is typically bigger than normal.

- 11 medical herbs being in study more or less have effect on radiation elimination or radiation protection. Two medicines with strong effects on radiation elimination is Na-alginate (obtained from brown algae) and hill burtt cataplasm. For 9 other medicines with the effect on radiation elimination with the reduction ratio >1 and with the dosage of radiation exposure 6-7Gy, the number of mice remained alive after 30 days is significantly bigger than in the group used for comparison.

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