Means of radiation intelligence

The classification of defeat ionizing radiation by nuclear explosion.

Radiation factors of a nuclear explosion and types of injuries.		
penetrating radiation	Radioactive fallout in the period of their Loss	Radiation in areas contaminated radioactive rainfall
1. Isolated lesions of the gamma radiation: acute radiation reaction, acute radiation sickness, acute radiation sickness, mostly of local radiation injury. 2. Isolated lesions of mixed gamma-neutron radiation: acute radiation reaction, acute radiation syndrome, acute radiation sickness, mostly of local radiation injury. 3. Combined radiation injury (as a result of the simultaneous action of other damaging factors of the explosion – the shock wave and light radiation): acute radiation injury combined with mechanical trauma; acute radiation injury combined with burns of the skin; acute radiation injury combined with mechanical injury and skin burns.	1. Skin lesions as a result of its contamination of the drop-down radioactive particles. 2. The defeat of the thyroid gland as a result of penetration into the body (inhalation) of radioactive iodine.	1. The total defeat of the body by gamma-radiation: acute radiation reaction, acute radiation syndrome, acute radiation sickness. 2. Skin lesions the result of remote and contact (in case of strong dust formation) of action of beta-radiation 3. Radiation injury caused by radioactive particles inside the body (often in combination with radiation sickness from external gamma irradiation).

The devices for measuring the dose.

1. Indicator-switch DP-64 is used for regularly radiation observation and alert about radiation pollution of environment. It works in monitor mode and provides sound and light alarm upon reaching on the location of the radiation dose of 0.2 R/h. Time alarm is not exceed 3 seconds.

The device is powered from AC voltage 127/200 to or from the battery with a voltage of 6 V. The device is operable in the temperature range from -40 to +50°C at relative air humidity up to 98%. The device is ready for action in about 30 seconds after switching on.

The set Indicator-switch DP-64 includes the device, technical description and instruction manual, product data, spare parts and accessories. The sensor is connected to the remote alarm cable length of 30 m. using the second cable panel is attached to a source of electrical power; this cable ends with a plug for connection to the AC power source and two terminals (+, -) for connection to the battery.

The detector of ionizing radiation - discharge counter STS-5 and control of radioactive drug are in the sensor.

Preparing the appliance for use.

Preparing the appliance for use consists of following serial techniques.

At the beginning the remote alarm is connected to the power source. Using batteries the conclusions of the power cable is joining the battery terminals, observing polarity.

If the indicator-switch is powered by AC voltage 127/200 V, the fuse depending on the voltage on the network is in one of the two positions indicated inside the compartment of the fuse.

Then plug cable included in the network, the toggle switch "On. Off." is set to "On", toggle the "Job Control" is set to "Control". If the unit is serviceable, trigger light and sound signals.

Then the toggle “Work-Control” is set to “Work” the device is ready to work.

In that case, if the dose of ionizing radiation equal to or greater than 0.2 R/h, trigger sound and light alarm; the frequency of the signals increases with the dose of ionizing radiation.

2. Radiometer-rentgenmetr DP-5A.

Radiometer-rentgenmetr DP-5A is used for measurements gamma-radiation and the presence of radiation pollution of environment and different beta-radiation.

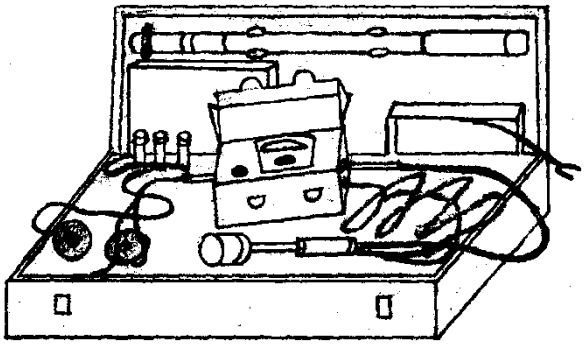


Fig1. The general view of Radiometer-rentgenmetr DP-5A.

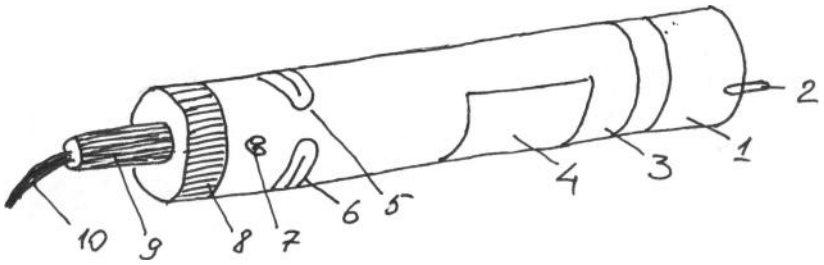
The dose rate of gamma radiation is determined milliroentgen per hour (Mr/HR) or roentgen per hour (R/HR) at a point of the space, which placed the measurements of the corresponding counter of the device. Radiometer DP-5A is able to measure the radiation levels of gamma radiation from 0.05 Mr/h to 200 R/h.

The construction and purpose of the device.

Technical description and operating instructions and schematic diagram are attached to each device. In the technical description set forth in detail the main characteristics of the instrument and rules of operation. Here is a General description of the instrument, and discuss in detail those main components, which have to meet directly in the production of radiometric measurements.

The device consists of the following main parts (Fig. 1): probe with flexible cable, instrumentation remote, head phones, box with the control source. In addition, the instrument includes a laying box, which houses an extension rod, power strip, set of spares and technical documentation.

The probe of the device (Fig. 2) is a steel cylinder, in which are placed the detectors, amplifier-Normalizer and other circuit elements. As the radiation detectors used in halogen counters of the types of STS-5 and C-3BG.



The probe of the device Fig. 2

1 - steel the probe housing; 2 - bearing pin; 3 - brass rotating cylindrical screen with cut-out; 4 - window in the casing of probe, sealed with a plastic plate; 5 - latch; 6 - retaining collar; 7 - supporting fork; 8 - coupling nut; 9 - PCB; l0 - flexible cable.

In a steel cylinder housing has a window cutout to indicate beta radiation. Window ethyl cellulose is sealed with waterproof tape. On the body of the probe is mounted rotating cylindrical brass screen which also has the cutout, the size of the matching window in the housing of the probe. The screen may slightly move along the body of the probe. To secure the screen in a certain position as it has two catches (tooth), which contains the letters B and G. In the case of the cylinder has a retaining flange in the form of a ring with two grooves for the retainer.

At the position B in the groove at the supporting fork, the window cutout of the screen is aligned with the window of the housing. In this position of the screen gamma and beta radiation pass through the aligned window cutouts and the plastic film and fall in counters.

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At the position of the locking G locking plug against the window of the housing of the probe overlaps the cylindrical screen, and access to beta radiation counters stops, the counters will generate pulses only under the influence of gamma radiation.

To change the position of the screen is necessary to move slightly it to the side of the support pin (latch out of the locking groove of the bead) and rotate to the desired position.

The electrical part of the probe is attached on a plateau. The probe housing is connected with the plateau by means of a cap nut. For convenience, the measurement probe has a handle. The flexible cable is 1.2 m long, connects probe with a remote device.

Measuring Board (Fig. 3) consists of the following main components: panel, cover, chassis cover and the battery compartment.

The panel (Fig. 3) is placed in the upper part of the casing (housing) and connects to it with two screws.

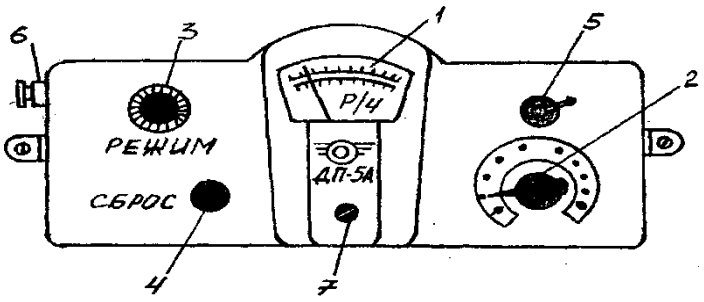

Fig. 3 The front panel of the radiometer-rentgenmetr DP-5A

1 - measuring unit; 2 - switch of the sub-bands; 3 - potentiometer adjustment mode; 4 - button reset; 5 - the switch of illumination of the scale; b - the socket to enable the phone; 7 - screw for zero adjustment (with safety cap).

Electrical measuring instrument - ammeter has two scales - upper and lower. The upper scale (Fig. 4,b) has 16 divisions: it is intended to determine the levels of gamma and beta radiation in the range from 0.05 Mr/h to 5 R/HR

readings on the upper scale is at work on II-IV sub-bands. The lower scale has 18 divisions. The readings on the lower scale is at work on I. the sub-band To sub-band I measured the levels of gamma radiation from 5 to 200 R/h.

The sub-switch has eight positions (Fig. 4,a). The purpose of the sub-bands, the view and interval of the measurements are shown in table. 2.

The measurements of the plot scale from 0 to the first significant digit are not working. Therefore, if the meter pointer is at the plot scale, necessary measurements are carried out on the next, more sensitive sub-band.

Fig. 4. The scale of the switch sub-bands (a) and measuring subrange (b):

1 - scale to measure the levels of beta radiation in sub-bands x 0.1, x1, x10, x100, x1000; 2 - the scale for measuring levels of gamma radiation in the sub-band 200.

Sub-band	Handle position switch	Scale	Unit	Interval	Duration of measurement, s
I	200	0-	Р/ч	5-200	15
II	x1000	0-5	мР/ч	500-	15
III	x100	0-5	мР/ч	50-500	40
IV	x10	0-5	мР/ч	5-50	60
V	x1	0-5	мР/ч	0,5-5	60
VI	x0,1	0-5	мР/ч	0,05-0,5	60
-	“Mode"		This position. switch sub-bands is made by adjusting the power mode of the device		
-	«Off»		The device is switched off		

The inclusion of headphones in the socket allows roughly, for a hearing to determine the intensity of radiation at work in all sub-bands except the first.

The screw of installation of zero is used in cases when the relief needle is not accurately set at zero. To bring the hands to the zero position, you must remove the securing screw on the front panel. Under this screw is placed in the recess of the second screw, rotation of it changes the position of the instrument pointer. The pad mounting is inserted the plug of the cable connecting the probe to the measuring console.

The casing, as well as the front panel is made from fiberglass. The casing is fastened to the cover with two captive screws. In the lower part of the casing has a compartment to accommodate power sources. Cover the battery compartment is connected to the casing by four screws.

Mounting chassis is enclosed in the housing. The construction and layout of elements described in some detail in the technical description.

The power supply is housed in a special compartment in the lower part of the casing. The unit mounted attachment for batteries 1.6 PMC-X-10,5 (KB-1), A-336. Circuit of battery is engraved on the wall of the compartment.

The device has a power strip which allows you to feed the radiometer from the constant-current source with a voltage of 3.6 or 12 BB, depending on jumper settings. Power strip is stored in the packing box. Schematic diagram of power supply pads and the scheme of its inclusion are given in the technical description.

Potentiometer adjust mode adjusts the power supply to the device. The normal operation of the device can be secured only by the observance of a certain mode power the device with electricity. Before starting the measurement, the switch sub-bands is set to "Dir." (mode). Knob Dir. arrow device mounted on a mark located on the top of the scale ("black triangle").

Button reset is used for quickly bringing the needle to the zero position (the "0"position).

The switch illumination of the scale is used when working at night.

The headphones consist of two small-sized phones type TG-7M and connected to the outlet located on the side panel. Phones are used for sound indication. Turn on the phone the sound (click-through rate) roughly to judge about the intensity of radiation.

Work with Radiometer-rentgenmetr DP-5A

To determine the dose of gamma radiation needs the following: prepare the device to work, check the efficiency of the device, to measure levels of gamma radiation.

Preparing the device to work

. Remove the device from the packing box and conduct a visual inspection for mechanical damage.

2. If the device is provisioned for the first time or after a long break, you need to install or replace the power supply. For installation of power sources, Unscrew the screws and remove the cover on the battery compartment. Three elements 1.6 PMC-X-1,05 (KGB-1) are installed in the compartment according to the diagram engraved on the inner wall of the compartment, the contacts established elements carefully trimmed. When power to the unit from outside sources, DC (3,6 or 12) use block power, pre-setting the two jumpers to the desired voltage.

C If necessary, with the screw zero adjustment to bring the arrow to the measuring instrument in zero position.

4. To turn the device on, put the switch to "Dir." (mode).

5. Knob "Mode" to set the arrow of the device on the label of the "black triangle" (▼).

When checking in the "Mode" arrow oscillates, but the oscillations it should not go beyond the blackened arc. If the needle does not reach the label "black triangle" (▼), it is necessary to test the validity of the power sources.

Check productivity of the device.

Health check of the device is carried out using a reference source, mounted on the lid of the case. With this source you can check the operation of the device in all sub-bands except the first one.

The health check is conducted as follows:

1. Open control source, rotating the protecting plate (screen) around the axis.

2. The screen of the probe set to position B.

3. Set the probe reference points on the source.

4. Connect head phones.

The device performance is verified by the presence of clicks in the phones. In working the device, the frequency of clicks increases with the increase of radiation intensity or when approaching the sensor to the control drug. The arrow of the device on the sub-bands * of 0.1, * 1 should go off-scale (to go way to the right), for sub-bands * 10, * 100 - to deviate, subband * 1000 - deviate slightly.

Measurements of gamma-radiation level

Before measuring the level of gamma radiation is necessary to set the mode and check the performance of the device. Setting operation mode is performed before each measurement of the levels of gamma radiation. Health check of the device is carried out daily or after a continuous operation, measuring the levels of gamma radiation is carried out at a height of 1 m, i.e. at the level of "critical" organs that have mastrodicasa cells, which are the most radiopriemnye – lymphoid tissue, the intestinal epithelium, cells of the red bone marrow, the epithelium of the gonads, cells of the skin.

You must do the following to determine the dose rate of gamma radiation unit DP-5A.:

a) to put the screen of the probe is in position G;

b) The switch sub-bands are put in a position "200" (in this sub range of the sensor is automatically turned off, and measurements are made directly by the counter located in the casing of the device, the location of which is indicated by the symbol +). 15 C. should conduct a reading on the position of the device on the lower scale. The resulting count indicates the amount of gamma radiation in x-ray

hours. If the arrow of the device on any sub-band deviates slightly, it is necessary to carry out a measurement on more sensitive sub-band;

c) turn the switch to the position * 1000 or * 100 (depending on the deflection). These sub-bands measured dose rate of gamma radiation in the place where the probe of the device. The countdown is on the upper scale of 15 s. the measurements of sub band * 1000 and 40 C. during the measurements in the sub-band * 100. The result of the count is multiplied by the coefficient sub-bands (* 1000, * 100) matches the measured dose rate of gamma radiation in Mr/h.

If the measurement is more sensitive sub-bands - * 10, * 1, * 0,1 - counts are held on the upper scale. Measurements duration 60 s. the scale reading multiplied by the factor of sub-band corresponds to a measured dose rate of gamma radiation VMR/h.

If the measurements on any sub range, the device rolls over (the arrow goes to the far right), then move on to coarser sub-band measurements.

The measurements should avoid readings at the arrow (at the beginning or end of the scale). With long-term measurements are required 30-40 min to verify the mode of operation of the device.

As already mentioned, the determination of the dose of gamma radiation is carried out at a height of I m. Thus it is necessary to watch, that when measuring in the sub-band 200, the control device was at the level of 1 m, and when measuring all other sub bands at the level 1 m was a probe.

Examples of measuring levels of gamma radiation and

determining the density of radioactive contamination.

In the table.3 are shown the levels of gamma radiation in Mr/h at different sub-bands at positions I, II, III, IV of the arrow of the measuring device DP-5A (Fig. 5).

The basic rules of handling device:

1. Contain the device clean.

2. Keep device from bumps and shaking.

3. Protect from direct sunlight, heavy rain and frost.

4. Off in between work.

5. To monitor the presence of grease in the thread of the housing of the probe.

6. Do not bend too much probe cable.

7. Do not exert more effort when the rotations of the handles of the potentiometer and switches.

8. After work in the rain the remote control and the probe wipe with an oily rag.

9. Every two years to carry out the calibration and instrument setup.

10. Unscheduled calibration and setup is performed by changing the counters, stabilizers or when replacing other parts, dramatically altering the device parameters.

11. After working in areas with high radiation levels to carry out decontamination of the device. The surface of the device carefully wipes with a damp cloth or swab to remove dust. Used rags and tampons are thrown in a special container or box.

The position measuring device	Sub-band					
	x 0,1	x 1	x 10	x 100	x1 000	20 0
	Milliroentgen per hour				Roentgen per hour	
I	0 ,4	4	4 0	4 00	4,0	15 0
II	0 ,28	2 ,8	2 8	2 80	2,8	92
III	0 ,2	2	2 0	2 00	2,0	50
IV	0 ,12	1 ,2	1 2	1 20	1,2	22

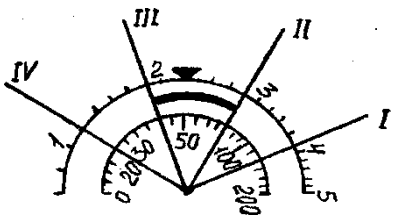

Fig. 5 The levels of gamma radiation at various
sub-bands of the device DP-5A.

The main differences in versions of power meters doses types DP-5A, DP-5B DP-5V.

The purpose and principle of operation of all modifications of the power meter dose (rentgenometer) DP-5A, DP-5B DP-5V are the same, and the difference between the modifications consist mainly in design and partly in the wiring diagram.

The unit DP-5B differs from the DP-5A with the following design changes:

1. Cover power sources in the device DP-5A four screws with a screwdriver, and the unit DP-5B, this cap is one special captive screw without using a screwdriver.

2. In the device DP-5A for measuring the dose rate in the sub-band 200 is used with additional gas-discharge counter of the type SI-3БГ, which is located inside the body of the remote, and the unit DP-5B is used for this purpose are available in the probe counter SI-3БГ. Thereby reduced the number of counters used in the device, and improved conditions for measurement of high radiation levels.

3. In the device DP-5A of the probe has a detachable short handle for measurements at close distances and extension rod for measuring at large distances, while in the unit DP-5B is used for this purpose only, extension rod design that is slightly modified.

4. Changed the design of the voltage divider for the implementation of the power supply DC voltage of 3, 6 and 12 V.

Differences in the modification of a meter dose of DP-5 and DP-5V are more substantial and consist in the following:

1. The instrument DP-5V keeps working after falling from a height of 0.5 m, as the panel body is made of press material having a higher mechanical strength than that of the unit DP-5B.

2. The instrument DP-5V has no "reverse" direction microammeter in transshipment exposures to sub-bands 4, 5 and 6 to 50 R/h, while the unit DP-5B - only up to 1 R/h.

3. The unit DP-5B reference radioactive source mounted on the inner side of the cover box of the device, and DP-5V it is mounted under the swivel screen of the probe, which eliminates any possibility of damage to the radioactive source and simplifies the process of checking the efficiency of the device.

4. The unit DP-5B in preparing the device for use, you must use the special potentiometer "Mode" to manually set the desired voltage supplied to the circuit of the device, in the process of measurement is necessary to periodically transfer switch sub-bands to "Mode" and conduct a tune-up stress. The instrument DP-5V in the circuit device adjusts a voltage to be applied to the scheme automatically, which significantly simplifies the work with the device.

The reduction of systematic errors when using meters dose of DP-type-5.

In modern conditions the importance of the acquired measurement accuracy, which is characterized by the proximity of results to the true value of the measured value necessary for practical use, besides the increase of accuracy of measurements is one of the ways of improving the knowledge of human nature, the most effective application of accurate knowledge. Improving the accuracy of measurement of the density of water has led in 1932 to the discovery of heavy hydrogen – deuterium, an insignificant amount which in normal water increases its density. Greater measurement accuracy is necessary and applicable to the values that characterize the physical phenomena associated with their impact on human rights. This requirement has a direct relationship to radiation and the values of its measurement, radiation monitoring instruments and, in particular, to the primary radiation survey device type DP-5, which requires careful and strictly consistent training it to use.

For this training of great importance is the setting of the mechanical zero of the micrometer, the correct identification and control of modes of operation of the device. For this handle "Mode" rotates counterclockwise to the left and brought to

focus if the arrow of the micrometer is beyond the zero mark, the proofreader set it exactly to 0. Then connect the power sources are provided in all sub-bands except the first one.

The left arrow and wait until it stops, if the arrow of the microammeter is beyond the zero mark, the proofreader set it exactly to 0. Then connect the power sources, strictly observing polarity. Connecting them and putting a switch sub-band in position Mode, set the arrow microammeter the scale mark "black triangle". This is especially useful in the case when the device is operating on older power sources and at low temperatures. The fact is that the electrical circuit of the device can properly function and give more accurate readings only at a stabilized voltage of 390 V, which is fixed by the arrow of the microammeter.

At a voltage of at least 390 to an arrow of the microammeter will not reach sensitive sector. In this case you need to replace the power supply.

The performance of the device must be checked for all sub-bands except 200, with a test source.

On the efficiency of the device is judged by the clicks of the phone and position the arrow. On the sixth and fifth sub-bands of hand, as a rule, surpasses the second and third may not be rejected due to insufficient activity of the control source. The deflection at the fourth sub-band must comply with the formulary entries when the last verification of calibration of the instrument. The auditory indication is provided on all sub-bands except the first one.

The left arrow and wait until it stops, if the arrow of the microammeter is beyond the zero mark, the proofreader set it exactly to 0. Then connect the power sources

When properly administered radiation detection switch sub-band is 200, the screen of the probe is in position, the elongated Probe in the side arm (excluding DP-5A) the stops placed down to the side at a height of 1 m, the detector device is oriented in space so that its axis corresponding to the maximum sensitivity parallel to the surface of the earth. The probe DP-5A in this case is in the case of the device, and the device is placed on the chest of the scout, in this case, the display

registered units should be multiplied by a factor of adaptation of the body, equal. 1,2. When working with this device on the 4th, 5th and 6th sub bands, the probe should be at arm's length, and then it is not necessary to use the coefficient of adaptation.

The areas of scales of devices of type DP-5 from zero to the first significant digit are holidays: on top of the scale - the area from 0 to 0.5, on the bottom - from 0 to 5. This condition is also necessary to consider the measurements.

The time of installation of indications on different sub bands varies. The higher the level of radiation, the smaller it looks. When radiation levels more than 500 Mr/h (first and second sub bands) needle after 10 s. occupies a stable position. At lower levels of radiation this time is for the third sub-band 30, for the rest - 45 S. Measurement of levels of radiation in the interests of the dose is as often as possible, especially on the first and second day after contamination. The frequency of measurement should be from 30 min to 1 h, in the last 3-4 hours.

When radiometric control measurement of the degree of contamination of the objects are in places where external background does not exceed the maximum permissible contamination of the site more than 3 times. Gamma background is measured at a distance of 15-20 m from contaminated sites.

To measure the degree of contamination, the probe should bring the emphasis to the object's surface and slowly moving it, to determine the location of the maximum pollution by the maximum frequency of clicks in the head phones or the maximum reading of the microammeter. Then probe it is necessary to install stops to the surface at a height of 1-1,5 sm and take readings to compare the magnitude of the gamma-ray background measured by a dose rate at the facility, and, if it is more background, to determine the value of radioactive contamination of the object by subtracting the value of the gamma background. Contamination of objects measured in all sub-bands except the 200.

For the detection of beta radiation on the contaminated object you must set the screen of the probe is in position B. the Increase in readings on the same sub-band in comparison with the readings of gamma radiation (the screen of the probe

in position D) will indicate the presence of beta radiation and, consequently, the contamination of the examined object by beta, gamma - radioactive substances, which increases the severity of the contaminated object with respect to the contact treatment by this object. The detection of beta radiation also necessary in order to determine on which side of tarpaulins, car body, walls of container boxes and kitchen containers, walls and partitions construction are the products of a nuclear explosion or other sources of contamination.

When measuring the pollution of liquid and loose substances on the probe is put on the case of a polyethylene film for protection of the sensor against contamination by radioactive substances.

Contamination of water and food is smaller than the surface of the object, and therefore, measurement can be conducted with less gamma background. Much more authentic measurement of contamination of water and food in the defenses that significantly reduce gamma-ray background.

For convenience, when measuring the contamination of various objects using an extension rod. It also allows if necessary to increase distance from a radiation monitor to the test object.