Apparently, there is no basis for believing that it will be possible to find limitations on solutions which will be sufficiently general and convenient in the practical aspect and which will substantially amplify the capabilities of γ-ray well logging. It can be assumed that a resolution of 0.05 m for γ-ray well logging is close to the limit. Of course, one cannot rule out other ways of increasing the efficiency of well logging, i.e., directed detection and increased accuracy of measurement of the γ-ray dose rate.

LITERATURE CITED

AUTOMATED SYSTEM FOR COMPREHENSIVE STUDY OF RADIATION AND HYDROPHYSICAL FIELDS IN THE OCEAN

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In order to carry out comprehensive oceanographic studies, including the study of radiation fields, it is necessary to concentrate a large collection of technical equipment for performing the measurements onboard a vessel [1]. On-line (real time) processing of the maximum possible number of synchronized measurements of the characteristics of the water mass and their presentation in graphic form with the help of a computer are also important. This is a result of the comparatively recent discovery of spatial variability in the hydrophysical characteristics of the ocean on meso- and microscales, on the one hand, and economic considerations in carrying out long expeditions, on the other. Instrumentation systems for studying the radiation fields in the ocean, based on the latest achievements in the techniques and methodology of nuclear physics, can be used, after suitable modification, to record some set of hydrophysical and hydrochemical parameters of the water medium simultaneously with radiometrical studies.

The automated system that we developed permits synchronous measurements of the differential γ-radiation spectrum of sea water and hydrological parameters: temperature, electrical conductivity, and pressure. In situ recording of the differential energy spectrum of γ radiation permits periodic monitoring of the radiation source in seawater and measurement of its intensity in a chosen energy interval (window). Problems in increasing the volume of transmitted information, unifying systems for transmitting various kinds of information, and increasing its reliability were solved by using the method of pulsed signal modulation using a binary code. The system includes a submerged block, a block for receiving and decoding information coming onboard, a NTA-1024 pulse analyzer, a programmable Iskra-125 computer, and a collection of peripheral blocks for storing and displaying information. Vertical sounding of the ocean by the developed sounder γ-spectrometer is carried out in order to make a preliminary study of the water mass structure and in order to make a rapid choice of levels for retrieving large-volume water samples for carrying out an analysis of radionuclides, tritium, radioactive carbon, and other elements, not measured in situ.

A block diagram of the submerged part of the sounder γ-spectrometer is shown in Fig. 1. The first sensors are similar to the devices presently used in heat-salinity probes. A binary convertor for the primary measured quantity was developed for each of these sensors. A ST-4-16 thermistor serves as a temperature sensor. Preliminary investigation showed that this type of thermistor has a comparatively small scatter in resistance values and is most suitable for use in a sounder. The resistance of the thermistor is converted,
with the help of a controlled self-excited oscillator circuit, into a frequency, which is recorded within some time in a sequential binary counter (BC) and thus coded into a binary code.

The signal frequency at the output of the PDV 200 B water pressure converter (WPC) depends on the pressure. In order to increase the resolution and pressure, this frequency is doubled and recorded on a counter in the same manner as the temperature frequency.

A sensor for γ radiation in seawater, a NaI(Tl) crystal with a diameter of 150 × 100 m, is placed in a capsule. The signal from the anode of the photomultiplier (PM) is converted by an analog–digital converter (ADC), operating according to the amplitude–time principle. The pulse amplitude is coded by a binary code with a discretization of 1/509 of the maximum value. The number in the binary counter ADC is the address of the channel in which this pulse is recorded.

The sensor from the ATsIT system [2], for which an analog–digital converter was developed, was used as the sensitive element in the seawater inductometer. The sensor consists of two toroidal transformers, electrically coupled with each other by the conducting water loop. An alternating voltage with frequency 40 kHz is input to the winding of the first transformer and the output signal from the second transformer is coded in a