

**THE FINAL REPORT**  
**on performance of consulting services**  
**against the contract № CS-NPA-Arctic-14/2010**

(Localisation and removal from a thermokarst crater of two radioisotope thermoelectric generators (RITEGs) of GONG type at the Kondratiev navigation beacon site in Ust-Yanski Ulus of Republic of Sakha (Yakutia))

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**The name:** «Localisation and removal from a thermokarst crater of two radioisotope thermoelectric generators (RITEGs) of GONG type at the Kondratiev navigation beacon site in Ust-Yanski Ulus of Republic of Sakha (Yakutia)».

**The reason:** Contract № CS-NPA-Arctic-14/2010 from 4/30/2010

**Customer:** «Executive management of the Russian program of the organization of investments into environment improvement» (EMRPOI), registered to the address: 117218, Moscow, Krzhizhanovsky str., №23, bld.5 (the mailing address: 119991, Moscow, GSP-1, Leninsky prospect, 19), INN 7710269619

According to the above-stated contract which provides performance of consulting services in four stages, within the limits of each of them the following was executed:

## **1 stage:**

Participants and executors of the given project - IBO "Selljahov" as the basic manufacturer of works and the provider of services, and subcontractors - were defined:

**The Tiksinisky Hydrographic base**, branch of the Federal State Hydrographic unitary enterprise. Within the limits of the contract carried out a duty of: direct extraction of RITEG devices, inspection and dismantle them, loading and unloading them, transportation RITEG devices after extraction.

**Federal State unitary research-and-production enterprise "Geological prospecting".** It was contracted for carrying out of complex geophysical works on object "Kondratyev" for the purpose of detection and fixing of a site of two buried RITEG devices in friable coastal sea adjournment.

During the same period the lease contracts on vehicles were concluded; namely - the lease contract from May, 18th, 2010 till October, 30th, 2010 on use of tractor PM №9631.

The lease contract on use of a snowmobile "Buran" from May, 18th, 2010 was concluded. A tractor and a snowmobile were forcedly left on the object «Kondratyev» after performance of works under the contract because of impossibility of movement on sea ice as in last dates of May and the first dates of June there were cracks both with water above ice. Returning back to Tiksi was carried out only by two cross-country vehicles.

The Contract № 1/21-06-10 of transport expedition about performance of flights of the helicopter on delivery of experts and workers to object «Kondratyev» was concluded with "Trias-Geo", Ltd, from June, 21st, 2010.

The contract of delivery of oil products №ПЦ-199 from June, 09th, 2010 was concluded on 11 tons diesel and 1 ton gasoline АИ-92 with Open Society "Oil company" Tujmaada-oil".

For dredging it was made folding portable the copras-lifts, equipped with «electrotelfer».

The necessary tools and the equipment were prepared: two motor-pumps, two diesel electric generators, two electric jackhammers, metalwork tools, electrotools and so forth.

The radio and navigating equipment was prepared: 4 portable radio stations – one for each vehicle, 2 radio stations (SW range), 2 satellite phones, 4 GPS navigators.

In the night from May 18 for 19<sup>th</sup>, an expedition (tractor with the PETROLEUM PRODUCTS on the hook-on sledge, two cross-country vehicles and a snowmobile) left Tiksi and has gone to the object «Kondratyev» on the ice of Laptev sea.

Workers, foodstuff, petroleum products, the equipment, necessary materials for arrangement to arrival of the basic group of specialists has been delivered to object "Kondratyev". This operation (road, there and back) took 16 days. Group of geophysicists from "Geological prospecting" has arrived to Tiksi from St.-Petersburg on June, 28th, 2010.

## **2 stage:**

Within the limits of the second stage following works according to the technical project have been spent:

- on July, 02nd, 2010 IBO "Selljahov"'s workers, research group of experts of "Geological prospecting" (St.-Petersburg) and the representative of Tiksin sky hydrographic base were delivered to object "Kondratyev" by air transport;
- an additional spadework on object "Kondratyev" was executed;
- radiating inspection of a surface of prospective site of RITEG devices arrangement was executed.

Also were executed:

- preparation of a platform for application of a complex of geophysical methods - removal of the metal subjects from the surface of a site of search works;
- research of a site with application of a complex of geophysical methods.

On the base of the analysis of the received information, the decision to make a trial digging for revealing of the reason of deep anomaly in the right slope of the ravine formed on a site of search was accepted.

On depth of 4,5 meters the gap in "a capsule" cavity (burial place of RITEG) from which the stream of the made foam dirty water has escaped was punched. The radiation control has shown absence of radiating pollution of water and a ground from "capsule".

RITEG was in the turned position on depth 6 - 6,5 m from level of a place of a bookmark of a felling on the right slope of a ravine. "Capsule" represented an ovoform cavity in diameter of 1,6 meters and height 1,9 meters, filled on 90 % with a thawed ground and on 10 % - with water and gas.

On July, 13th, 2010, after preliminary survey, preventive actions and a spadework, RITEG № 12 has been taken on a surface.

After moving taken RITEG, dismantle of the crane, removal of all metal subjects and tools repeated search with application of a complex of geophysical methods was spent.

Results have given trustworthy information about the burial place of the second RITEG: to the west from an axis of the digging and more deeply than the first one.

After processing of in vitro the received information and detection of devices in a predicted place experts of "Geological prospecting" gave the entire account about the applied geophysical methods of search and the equipment used thus. (The Report of "Geological prospecting" is applied).

### **3 stage:**

Within the limits of the third stage following works according to the technical project have been spent:

By result of excavating the trial digging (extraction RITEG №12 on July, 13, 2010 and preservation of an abnormal signal), has been decided to use it as the basic and to continue in it excavating works. Trial digging has been protected by the second felling, it was imposed by a thermal protecting material in bags and turf.

From 16.07.2010 till 02.08.2010 it was conducted vertical excavating to 10-10,5 m depth, and from the level of 8-9 m depth the horizontal excavating was executed. On the distance of 2-

2,5 m from the western wall of digging the gap in a cavity (burial place of RITEG №13) has been punched 06.08.2010. Water and a liquid dirt have been merged from "capsule" in a cavity at the bottom of vertical digging below the level of 9 m.

09.08.2010 after necessary researches, removals of a viscous dirt from a cavity (burial place) RITEG №13 was taken on a surface. Actual depth of burial place of the device - 8,5 m from a surface (from level of a bookmark of a felling on the right slope of a ravine). Both RITEG devices were surveyed, prepared for transportation and moved on a horizontal platform; established: №12 – on wooden logs, №13 - on metaloplast board. The platform was enclosed by a wire protection on which warning signs «radiating danger» were fixed.

Are issued:

- The certificate №1-2010 from July, 14th, 2010 - Detection, extraction and inspections of radio isotope thermoelectric generator (RITEG) «GONG» type №12, 1988 of release;
- The certificate №2-2010 from August, 09th, 2010 – Detection, extraction and inspections of radio isotope thermoelectric generator (RITEG) «GONG» type №13, 1988 of release;

The certificate of transfer of two RITEG devices to representatives of Tikinsky hydrobase on object "Kondratyev" from August, 16th, 2010.

All certificates are applied.

#### **4 stage:**

Within the limits of the fourth stage according to the technical project drawing up of the total report on the executed works, including recommendations about the organization of works for site definition of RITEG devices, lost owing to active coastal processes, their extraction and transportation to a place of time storage or recycling was provided.

Detection RITEG devices, determination the depth of their immersing in a frozen ground and the formed relief of a site allow to make the analysis and to describe the process of their movement in frozen grounds. In 2002 workers of the hydrographic base which are carrying out navigating maintenance of sea communications around Laptev sea, found out final fracture of a navigating sign "Kondratyev" and loss of two radio isotope thermoelectric generators in Ust-Jansky area of Sakha (Yakutia) Republic.

In 2003 experts from «VIRG-Rudgeofizika» performed geophysical works on definition of site of RITEG devices. It was thus noticed that the prospective their burial place is on distance of 50-60 meters from a ledge of intensive thawing of the top part of an ice complex. From experience of supervision over movement of similar terraces it is known that their maximum speed reaches 7-8 meters a year. Hence, the fall of the devices from a terrace ledge

has occurred not later than 1998, and they were in direct contact with ice adjournment more than 10 years. It speaks also that the turf layer, falling from an ice ledge, is broken off on pieces and can't hold on a surface heavy objects any more (such as RITEG), and heat radiated by them forms local melting at direct contact with ice adjournment and, hence, further them depth increase.

Process of immersing and disappearance from a surface could occur within 1-2 years to formation of a thermokarstic funnel. Funnel presence in a place of prospective immersing of RITEGs was observed in 2003 by experts from «VIRG-GEOPHYSICS».

The next years, with increase in depth of immersing, influence radiated by devices heat on upper layers of earth, has stopped, and the pieces of turf slipping on a terrace aside the sea, have grown together in the uniform layer which has hidden a place of the former thermokarstic funnel. To define a place of immersing the devices using a site relief information it became impossible. Immersing RITEGs proceeded during all period of time from the moment of a collapse from a ledge of a terrace and irrespective of a season. The distance passed by the devices on a vertical, as have shown calculations, has made 15 and 18 meters with a speed 1,6 – 1,7 meters a year. Immersing the devices more deeply was interfered by «pallets-runners» available for them which have executed a role of «brake parachutes» (both devices were found in the turned position). For seven years the terrace ledge has departed towards a land on 120-130 meters, and the distance from an assumed place of immersing the RITEGs to it has increased to 180-190 meters.

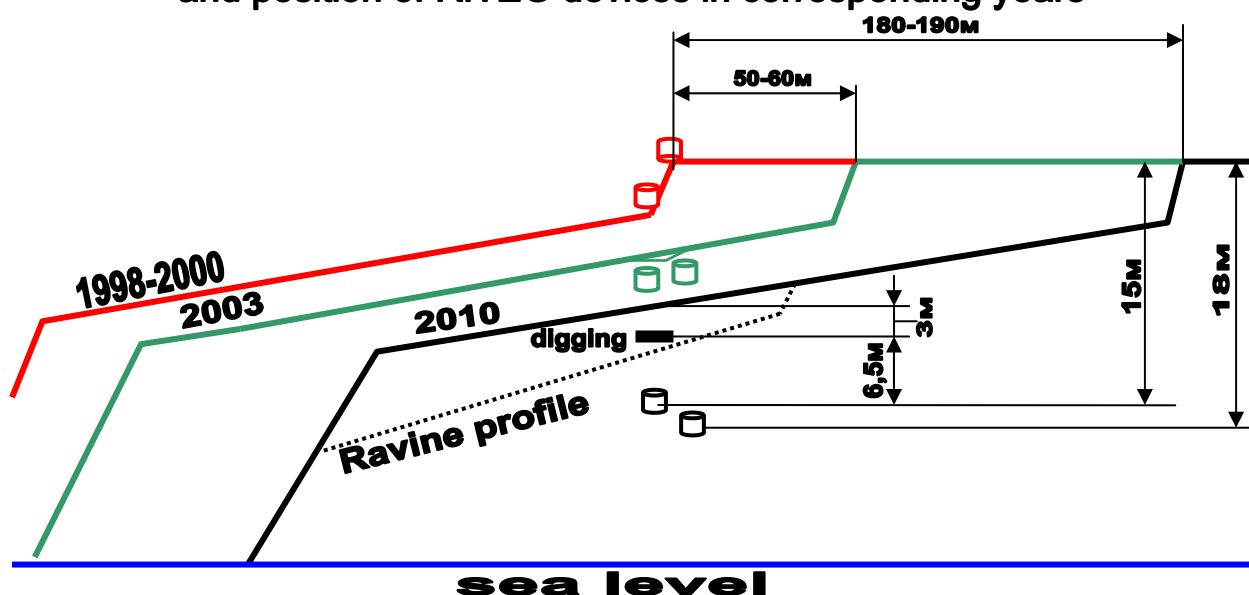
The terrace surface thawed and gave during the summer period, but with smaller speed than devices plunged. Depth of immersing of two devices relative to a terrace surface has made 9,5 and 11,5 meters.

Due to the fact that the digging has been put in one of the ravines formed on a surface of a terrace, its depth was reduced to 3 m.

After extraction from digging the devices were moved manually with use the systems of blocks and cables.

**It is recommended** to use a complex of geophysical methods (magnetic investigation and a method of transients) for the works connected with searches of the buried thermoelectric generators. High efficiency of a complex of geophysical methods of search of buried metal objects has been noted at a stage of clearing of a site. Were found out and removed little metal subjects from depth to 1- 1,5 m, that has allowed to reveal the deep anomaly which origin could be only from RITEGs.

### The scheme of change of a profile of a terrace and position of RITEG devices in corresponding years



The complex of geophysical methods of search of metal objects can be successfully applied and at their burial as a result of landslide or other processes.

(The report of experts from "Geological prospecting" is applied).

Excavating in frozen ground is recommended to carry out only in conditions of negative temperatures. Besides, negative temperatures allow to use heavy caterpillar and other technics for the auxiliary and transport purposes.

**Maintenance of radiating safety** on object "Kondratyev" has been assigned to the Dobrobaba V. A. - representative of Tikinsky hydrobase.

**Transportation of RITEG devices.** In the Arctic regions in the conditions of absence of roads the scheme of transportation RITEGs by sea transport with helicopter use at their unloading and loading is applied.

RITEGs, taken from a ground on object "Kondratyev", are established on a platform excluding their repeated overturning and immersing in the summer period of 2010. Use of caterpillar transport for transportation RITEGs during the summer period is impossible because of nature protection norms and total absence of roads. For transportation RITEGs to the equipped platform of time storage on object «Svyatoy Nos» (the platform is equipped and operates from 1990) it is planned in March-April 2011 to use the tractor TT-4 left in the spring 2010 on object "Kondratyev". About performance of this work we accept guarantee certificates before Tikinsky hydrobase. It will be made regular evacuation of RITEGs from the object «Svyatoy Nos» with helicopter and survey vessel use.

During the navigation 2011 Tikinsky hydrobase will export RITEGs from a navigating sign "Tchurkin" and from a navigating sign "Chronometer", which are in 60 km from a platform of time storage «Svyatoy Nos».

Director IBO "Sellyakhov"

F.V.Sellyakhov