

The dynamic analysis of natural environment change of nuclear test field in Lop Nur region of China

Hu Dongsheng^{1,2,3}, Pang Xilei¹, Zhang Huajing⁴, Xu Bing⁵,
Yu Xuefeng², Tian Xinhong³, An Zhisheng², Zhang Guowei³

(1. College of Resources Environmental Science, Hunan Normal University, Changsha 410081, China; 2. State Key Laboratory of Loess and Quaternary Geology, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an 710075, China; 3. State Key Laboratories of Continental Dynamics, Northwest University, Xi'an 710069, China; 4. College of Chemistry and Chemical Engineering, Hunan Normal University, Changsha 410081, China; 5. College of Ocean Geosciences, Chinese Ocean University, Qingdao 226071, China)

Abstract: Using earth satellite observation means, remote sensing information distilled technique and regional research production, we have roundly analyzed and made an integrated evaluation about the Lop Nur nuclear test field in western China. This product reveals the rarely-known nuke explosion effect and response events of geology conditions. It also offers us legible and practical first-hand materials about human extreme effects, important engineering environment and intimidating influence process. By excavating and appraising the materials gradually on the natural environment factors changing in the test field through macroscopic elimination and typical filtration, it can supply basic scientific data for security of national nuclear usage, appraising the nuclear environment synthetically and developing nuclear strategy expediently.

Key words: earth's satellite observation; the nuclear test field; the nuke explosion effect and the response process of geological environment; comprehensive evaluation of natural resource environment; Lop Nur region of China

1 Introduction

In the middle of 20th century, the most powerful manual energy during the human history—the atomic energy (nuclear energy) came into being. Nuclear energy is being used as the preferred clean energy source. China has already been one of the pioneers of the nuclear power's exploitation. As the first nuke explosion area, Lop Nur nuclear test base has lost its mystery, everything has been removed away, and now it is completely antiquated and is becoming a free area. Nuke explosion becomes a new geology process in earth's movement, and it also a new-style anthropic geology process.

This paper adopted the method of earth satellites remote sensing technique to research the area, which opens out some unwonted dynamic state materials of the nuke explosion scenes and the changing conditions of the aftereffect environment. It accumulates science data for the typical important engineering effect and the environmental integrated evaluations. It also provides basic data for the mankind's peaceful utilization of the nuclear energy resources and its natural environments response. And all of these can establish foundations for

human beings sharing one "global village" and owning their harmonious societies.

2 General picture of the test area

The Lop Nur nuclear test field is located in a miniature sub-basin at south foot of the Middle Tianshan Mountains of western China. The basin's central average elevation is 1 100 ~ 1 150 m, and the average elevation of the circumambience mountainous regions is 1 300 ~ 1 400 m, this is a half-closed and extremely droughty. It is still an unmanned area up to now within the radius of 200 km. According to the Tianshan Mountains area of the region climate investigation data^[1], the basin's climate parameters are: annual sunlight hours are 3 200 h, annual relative humidity is 40 % ~ 60 %, annual evaporation quantity is 3 500 mm, annual rainfall quantity is 50 ± mm, average temperature of the January is -23 °C, average temperature of the July is 25 °C, the perennial prevail wind direction is SW, perennial annual wind speed is 3 ~ 4 m/s, annual gale (more than 17 m/s, 8 grade) days are about 30 ± d.

The ecological environment belongs to arid rock-desert climate organism belt of variable zone. Surrounding mountainous region is a bare rock habitat

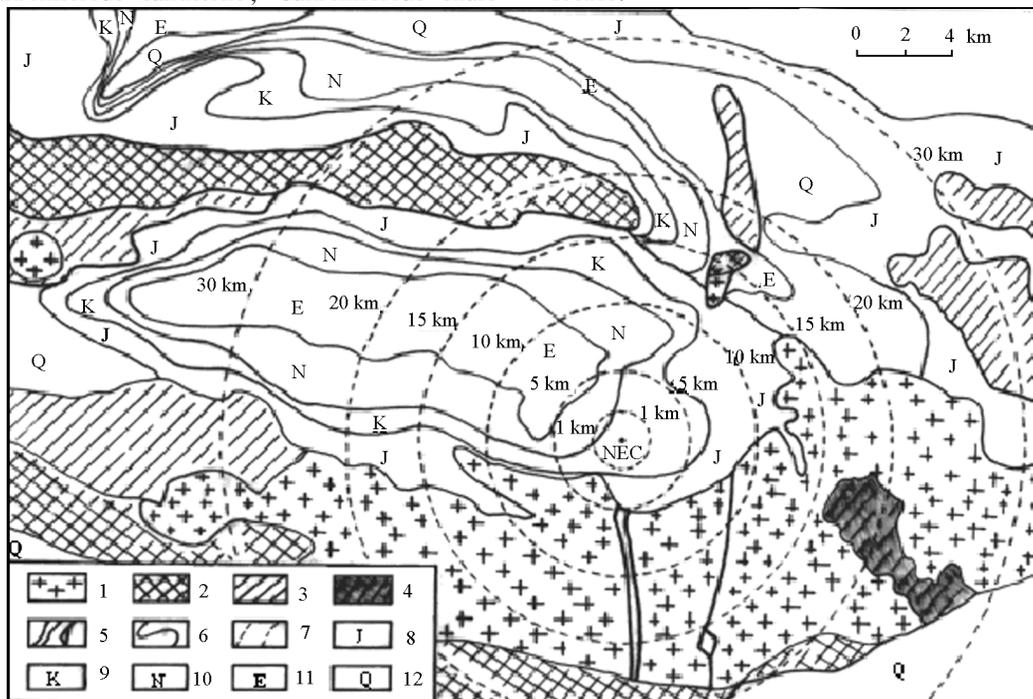
without vegetations, and the interior basin is a habitat with arid hungeriness vegetations. The flora is mainly occupied by the drought rawness semi-bushy vegetations, and its constructive species mainly include the *Ephedra*, *Alhagi pseudalhagi* and *Zygophyllum*. The vegetations sparsely distribute along the diluvium fan belt and salluvium fan belt coverage is less than 5%. The fauna belongs to Palearctic Central Asian subregion Mengxin western hungeriness subregion. The resident animals here are *Lepus capensis*, *Apus apus*, *Caculus cunorus* and *Alectoris graeca pubescens* always moving around the semi-shrub area, but beasts such as *Canis lupus* and *Vulpes vulpes* can be rarely seen here.

The test field is an oval and EW spreading (N 80° W) half-closed basin, the Kalatage Mountain locates at the north side and the Kezeletage Mountain locates at the south side of the basin, there are two half-closed exits at the western end and the north-eastern part. The basin's long axis at EW direction is about 30 km, and the short axis closely extending along NS direction is about 10 km, so its total areas are about 300 km².

The stratum formation of surrounding mountains mostly is lithofacies combination of Devonian marble, Devonian schist, Devonian tuff and Carboniferous limestone, Carboniferous sandstone, Carboniferous shale

and extrusive rock; the southern mountains contain spacious invasive Permian granite. From the mountain's piedmont belt to the central belt in the basin, the rocks distribute in turn: Jurassic Period's rock system of conglomerate, sandstone, marlstone and coal bed; Cretaceous Period's rock system of conglomerate, sandstone and marlstone; Tertiary Period's rock system of sandstone, marlstone and gypsum rocks. These stratum rocks have been strongly weathered and strongly disintegrated, most of them present to be half-lie and concealed monadnock intermittently, its upper strata all have been covered by loose accumulation of Quaternary sediments including aeolian sediment, diluvial sediment and alluvial sediment (Fig. 1).

The formation of the basin is actually an aftereffect gravity adjusting progress of the Tianshan's composite fault-fold structure system after the rejuvenation activity at the Mesozoic era. Influenced by the Cenozoic structural function it completed the small type collapsed synclinal structural basin, and its final formation time is the late stage of the Tertiary period. The basin has been suffered reformation with weathering, denudation, sediment and alluvium since the Quaternary Period. The basin's basement structure is relatively stable, and neotectonics movement in the basin's interior area is feeble.



1—Granites of Hercynian; 2—Stratum of Devonian Period; 3—Stratum of Carboniferous Period; 4—Repeat fusional stratum of coal measures; 5—Repeat fusional carbonatite dikes; 6—Geological boundary line; 7—Influence line of experiment radius; 8—Stratum of Jurassic Period; 9—Stratum of Cretaceous Period; 10—Stratum of Palaeogene Period; 11—Stratum of Neogene Period; 12—Stratum of Quaternary Period

Fig. 1 The distribute map of geological position in the nuclear test area of Lop Nur

The nuke explosion area locates at the southeast of the basin, and by analyzing earth satellite observation and characters of ground landscapes, the geographic position of the first nuke explosion center is about $41^{\circ}43'N$, $88^{\circ}44'E$. The elevation of nuke explosion point is about $1\ 100 \pm m$, and its terrain is open and flat, it is the edge belt of the diluvium-alluvium fan area in front of piedmont. It just locates at the fringe cross part of the two diluvium-alluvium fan, it is 2 km from the nearest southern mountainous region. It is 4 ~ 5 km from the nearest eastern mountainous region, 6 ~ 8 km from the nearest northern mountainous region and 20 ~ 25 km from the nearest western mountainous region.

3 Nuke explosion effect

In terms of nuclear physics^[2], antipersonnel and destructive detonation energies from nuke explosion mainly are: shock wave, ray radiation, nuclear radiation, radioactive taint and electromagnetism pulse.

And in all of the energies released from the nuke explosion, shock wave accounts for about 50 %, ray radiation accounts for about 35 %, nuclear radiation (early stage) accounts for about 5 %, radioactive taint accounts for about 10 %, and the electromagnetism pulses mostly damaged the electronic apparatus.

During the nuke explosion process, what first appeared is a super-strong flash of light, then the powerful shock wave, then the high temperature burning and the nuclear radiating (early stage) on the morrow of, while radioactive taint takes effect following the explosion cloud and atmosphere dust diffusing and landing, and the electromagnetism radioactive comes into being at the explosion moment and lasts until the end of the nuclear reaction process.

Applying the remote sensing information interpreting production and considering the damage and alteration to the land sights and the intimidated response condition of the environment brought by the explosion, we divide Lop Nur nuclear test field, from the core to periphery area, into six multilevel concentric incidence areas as follows: 1, 5, 10, 15, 20, 30 km (Fig. 1).

1) 1 km incidence area, core zone of the nuke explosion area. In the radius range of $250 \pm m$ of the core belt, there are some anisomerous trigonal extreme explosion sections, and all of the artificial structures and natural sceneries on the ground are completely melted down into vaporization (or partly vaporized), leaving over piles of residual adust black stuffs in colloid melting shape as yet. In the radius range of 250 ~ 500 m apart from the core, higher floor substances of the man-power buildings were cleared off without accumulation, only few low floor and high strength constructions (un-

der 3 m) were saved. Along the inner edge (250 m), the experiment rails are partly melted and curved, with their physical structure having been altered, there exists metasomatic or entering phenomenon by siliceous and hydroxide. Along the outer edge (500 m), the terrene entrenchments are retaining their primary faces, and it has suffered little visible physical destruction. And other combustible and fusible matters almost have been demolished. At the outer edge (500 ~ 600 m), there appears such phenomenon as annular structure, linearity rift and the spring scoured trails, etc.

2) 5 km incidence area, weapon engineering test belt of the nuke explosion area (Fig. 2). This area mainly contains two concentrate test belts (A belt, B belt) and a few scattered test belt (C belt), there were mostly weapon tests such as various driving force instruments and artillery apparatus, there were 70 ~ 80 items or 130 kinds of experiments, had been burnt out completely.

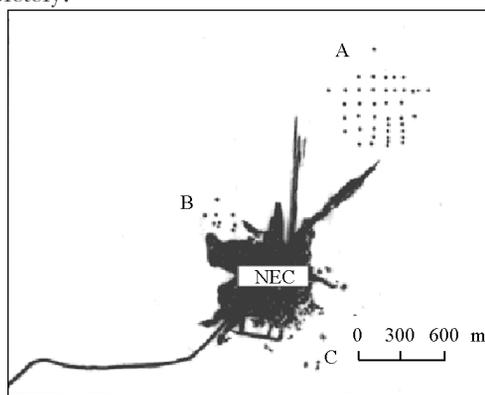


Fig. 2 The distribute map of experimented engineering in the nuke explosion area of Lop Nur

3) 10 km incidence area, the barrack engineering test belt of the nuke explosion area. There are mainly three concentrated test belts and a few scattered test belts in the incidence. Most of the buildings were civil engineering as rampart establishments. The surface buildings have been nearly mopped up without residual accumulations, only the basic contour of entrenchment and dust-wall are preserved, and a spot of living implements were burnt out completely after the explosion.

4) 15 km incidence area, a ground straightly destructed verge belt on the ground in the nuke explosion area. The explosion damaged the artificial structures selectively, and there exists some partial melted alternations on the surface of asphalt road, whose spacing is about 320 ~ 760 m, and its spreading scope actually is from 3 km apart from the core point to 7 km apart from the core point.

5) 20 km incidence area, periphery incidence belt of the nuke explosion area. There is no remarkable

damage on the ground, and no distinct melted phenomenon on the surface of the asphalt road, only a few sections of the road have been gently melted and intenerated on the edge.

6) 30 km outer area. There is no straight damaging phenomenon on the ground. It is basically beyond the effect of the nuke explosion, and gradually gets back to its normal state of the peripheral region.

4 Geological environment response

Affected by manpower nuke explosion, the earth environment materials (including the lithosphere, biosphere, atmospheres) occurs intimidating response, it could bring multifarious phenomena such as metamorphosis, degenerescence and transformations. Those kinds of trails of the remainders are important carriers for researching and analyzing of the nuke explosion influences, they are also important practical proofs for comprehensive environment valuation.

4.1 Ground engineering

In a broad sense, the surface artificial engineering belongs to geology environment substances, namely human-geology-environment effect substances. In the diameter of 500 m of the core explosion area, multifarious manpowered experiment establishments and ground features are all absolutely melted into colloid state. And in the diameter range of 500 ~ 1 000 m, no entire look construction can be seen except some perpetual and high strength based ones near the earth's surface. Actually, the 1 km incidence of the test area is a death zone without ecosystem, so the geological environment response discussed in this paper means the area out of the 1 km incidence belt.

1) Weapon engineering. The weapon engineering distributes in the 5 km incidence area. Its typical ground response structure traces are burnt spots owning annular structure and navels. Since the different volume and combustibility bulk density of the experimental materials, the scales of the annular formations differ in ranges. The maximal diameter of the annular structure is 33 m, and the minimal diameter is 5 m, and the center's remnant burnt diameter is about 0.5 ~ 2.5 m, gushing phenomenon occurs at several strongly affected centers but with nonoccurrence of overfall currently. These annular structures are derivate structures caused by high temperature blast during the nuke explosion process.

2) Barrack engineering. The barrack engineering distributes in the 10 km incidence area. Its typical ground response structure traces are constructions that have been cleared away except the lower floor foundations near the ground and the entrenchments. And ex-

plosion-burnt points appear little in this test incidence. This circles related to the properties of experiment things, and also related to different effects due to the nuke explosion process. That area has been strongly suffered breakage by the shock wave, but it shows that the nuke explosion temperature declined markedly.

3) Road engineering. The projects distribute in the range of 1.6 ~ 7.2 km (namely the 3 ~ 15 km incidence area) apart from the nuke explosion center, the roads presents discontinuous and repetitious melted state, and their spacing range is 320 ~ 760 m. There are 11 notable melted belts on the road surface. These states mainly represent such phenomena as softening, fusion and diffusion on the surface of oil residue roads, and the average spacing is about $500 \pm m$.

4.2 Ecology on the earth's surface

According to the remnant relics in the nuke explosion process, the destructive complexion of the earth's surface can be divided as follows:

1) 1 km incidence area, a nonliving area. All livings have been killed by effects such as high temperature, high pressure and strong radiation, etc. ;

2) 5 km incidence area, due to attenuation of the explosion energy and short semi-fruticose foliage here, about $75 \% \pm 5 \%$ vegetations have disappeared or have been destroyed;

3) 10 km incidence area, about $40 \% \pm 10 \%$ vegetations have disappeared or have been destroyed;

4) 15 km incidence area, about $15 \% \pm 5 \%$ vegetations have disappeared or have been destroyed;

5) 20 km incidence area, in and beyond this area, vegetations basically have not suffered marked breakage and influences.

According to analyzed data about the ruined vegetations' vestige, it shows us a current that damage to the vegetations increases gradually following its living scale in the nuke explosion area. In other words, the higher the creature's density is, the more damage it would suffer. It is significant to techniques such as anti-radiation, antinuclear, antipollution and safe usage of nuclear.

4.3 Geology of the superficial stratum

The explosion affects the earth's surface and the matters of superficial stratum more evidently in the nuclear test area. Comparing with this, the underground nuke explosion influence a maximum depth of $100 \sim 200 \pm m$ underground. It is very important of the earth's surface process and superficial geological process affecting human beings and our environment.

1) Geological function. Geological functions mostly take place in granite extending area of the Permian Period in the southern mountainous region, and

its incidence is in the 5 ~ 30 km incidence area. In addition, in diameter of 500 m incidence of the nuke explosion center area, all the surface substances are melted and colloided so as to basalt-vitrification, and its influence depth can reach 1.5 ~ 2 m underground. a. Calcite veins are carbonized; the some of this phenomenon exist at the south of the nuke explosion area, there are two parallel belts, their spacing is about 164.3 ~ 383.3 m, and respective width is about 2.3 ~ 33.6 m. Both of them have well continuity. As a whole, it extends along NNW (N 10° W) direction, and its length is about 6.134 km. Another one exists at south-south-eastern site of the nuke explosion area, it extends along NNE (N 15° E) direction, its width is about 3.4 ~ 67.2 m, its extending shape is like bamboo joints or a string of beads. And its extending trend is more stable, its length is about 7.391 km. b. Carbonization and combustion phenomenon in coal strata; it distributes at the south-east of the nuke explosion area, it shapes in rectangle block, its length is about 6.5 km, its width is about 1 ~ 2.6 km, its extending direction is NW (N 40° W). The stratum which formed at Devonian Period is a suit of coal system formation.

2) Hydrologic phenomenon. Stratum reversal caused by the nuke explosion brings the superficial underground water emerging. This phenomenon basically distributed at north of the nuke explosion area, the wellspring stratum which belong to the Jurassic stratum have two main locations as follows. a. Western part is like lotus-leaf. Due to the stratum reversal caused by the explosion in the middle-west of the nuke explosion area, the superficial underground water effused and flooded towards north along in gentle slope of the basin and formed a surface stream watercourse about 140 m long, then formed an alluvial fan wide about 50 m. In the front of the alluvial fan is a seeping lake, whose area is about 80 m² and the water depth is about 1 ± m. b. Eastern part is in shape of interlink. It derives from underground water gushing process caused

by the reversal of shock explosion center, all the phenomenon appear in billabong of the annuloid structure center, and the billabongs' areas differ along with the different magnitude of the explosion. From the west to east (from the explosion center to radiate fringe), the accumulate water billabongs' areas in turn are: 85 m × 10 m, 35 m × 10 m and 10 m × 5 m, and their water depths are about 0.5 ± m. After the nuke explosion, all of these seepy lakes and billabongs dried up immediately as a result of suffering high explosion temperature and dry weather, and then turned into surface saline alkaline crust and folium saline earth-film.

3) Renascent structures. The renascent structure presents annuli structure caused by the concussive nuke explosion. This is differ from and larger than the mini-type annularity structure (whose diameter is less than 33 m) caused by the weapon engineering explosion. Its formation is because of high-octane blast generated from the atomic fission hitting onto the ground during the nuke explosion process. Its structural scales are generally very huge. There are mainly two significant cases in the north of the explosion area. a. The west segment develops three folded-rampart annularity structures, each diameter is about 50 ~ 70 m, and the annularity rupture and explosion lips are clear and consecutive, there are some tiny springs of diameter less than 10 m or even no spring. b. The east segment develops a three-interlink-annularity structure (Fig. 3), whose array direction is transmeridional. The middle one is armillary ring and another two are elliptical, their diameters respectively are: 130 m × 80 m (west part), 70 m × 70 m (middle part) and 70 m × 50 m (east part). It develops turnup stratum and gushing phreatic water in the center area, with the annularity rupture and the explosion lips are clear and orbicular. It develops seriate arc enclosure lines at the north edge. It also developed discontinuous linear ruptures and crack line structures in north-west part of the nuke explosion area.

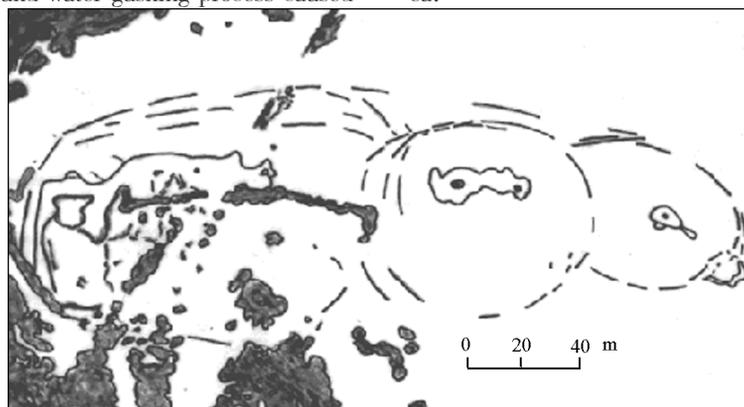


Fig. 3 The distribute map of the wreath structures in the nuclear test eastern area of Lop Nur

5 Comprehensive evaluation on the natural resource environment

Making a comprehensive evaluation on the natural resource environment of the nuke explosion area is a novel task, which includes instantaneous infection, short-term infection and long-term infection. It brings profound alteration to the earth substance's movement and significant impact on human environment, and even some influences have global significance. According to the observation materials from the earth satellites, we have been discussing and analyzing several important factors of the visible influences, and we are looking forward to objectively grasping that how the Lop Nur nuke explosion intimidates and takes long-term effect on the earth's surface system and geology environment.

5.1 Damage energy

According to the experimental data, the explosion equivalent of the first A-bomb of China is about 22 000 t TNT, equaling to the acquittal energy of 5th Richter grade earthquake converted in expressions of " $\log E = 11.8 + 1.5 M$ "^[3]. However, its damage intensity to the earth's surfaces, with which no natural earthquake can compare, is more than 12 degrees at anywhere in the 10 km incidence of the core area. The damage energy is only the concussion energy of the nuke explosion experiment, not including the energies such as ray radiation, nuclear radiation, radioactive taint and electromagnetism pulse, etc. Especially, the damage degree of the nuke explosion to the manual buildings on the earth's surface is tremendous. Based on the effect evaluation of the experiment area, the earth's surface damage intensity (equal to 20 000 t TNT) is more than 10 ~ 12 degrees in the 30 km incidence, relatively it requires damage energy of more than 8 ~ 10 magnitude of earthquake. And this circs is peculiar or even impossible in the nature. The status shows that the volume for the nuclear energy, being a man-made technique, is the most powerful energy source or resource nowadays all over the world. It is absolutely able to benefit human beings if its exploitation is under control and peaceful utilization.

5.2 Temperature infection

The data of artificial shock wave experiment^[4] on the natural rocks is as follows: the rock can be vaporized when its temperature reaches to 5 000 °C; the mainly forming minerals of the rock get melted when its temperature reaches to 3 000 ~ 2 000 °C; the rock gets selective melted when its temperature reaches to 1 500 ~ 1 200 °C; the rock appears phase change when the

temperature is 300 ~ 200 °C; the rock suffers plastic deformation when the temperature is 200 ~ 100 °C; and the rock appears break when the temperature is below 100 °C.

According to the natural U^[5,6] whose melting point is 1 132.3 °C and boiling point is 3 818 °C^[5], it is estimated the changing state of the temperature during the explosion process by evaluating the damage degree to the ground in the nuclear area. It is regionalized the temperature distribution as follows: the core area's extreme limit temperature is about 5 000 ± °C, the 1 km incidence area's temperature is 5 000 ~ 3 000 °C, the 5 km incidence area's temperature is 3 000 ~ 2 000 °C, the 10 km incidence area's temperature is 1500 ~ 1200 °C, the 15 km incidence area's temperature is 300 ~ 200 °C, the 20 km incidence area's temperature is 200 ~ 100 °C, the outer 30 km incidence area's temperature is under 100 °C.

5.3 Ecological status

The test area's vegetation belongs to xeromorphic semi-bosk, and most of the plants structure has vascular bundle texture, which can store moisture engendering its own circulatory system called tiny water-circulatory-ecosystem, so they possess functions such as anti-drought and anti-high-temperature. High temperature comes from the nuke explosion lasts ephemerally, it is similar to the flash vaporization process of the man-made high temperature, as long as it suffers screen and block its functions would be cut down. Therefore, except the nuke explosion area (the 1 km incidence), all the outer incidences exist livings' vestige and remnant during the explosion process. From the core to periphery, the remnant rates of the vegetations are: 20 % ~ 30 % (the 5 km incidence area), 50 % ~ 70 % (the 10 km incidence area), 80 % ~ 90 % (the 15 km incidence area), 90 % ~ 100 % (the 20 km incidence area) and basically no influence beyond the 30 km. Through 40 year's evolvement, except the nuke explosion area being a nonliving region, the peripheral vegetations have been basically reviving and have appeared rebirth phenomenon.

5.4 Resource accretion

According to experimentation^[6], it will produce plentiful nitric acid radicals and nitrates when the air is heated up to 1 200 ~ 3 000°C. The air can synthesize lots of nitric acid radicals and nitrates during the nuke explosion, and some modern palingenetic nitrate sediment have been found in the saline basin of the lower reaches along the airflow moving direction in the test area^[7].

At the north-east direction (N 25° E), in the

surface layer of the stratum of Wuzunbulake saline basin 25 km apart from the test area, several nitrate sediment have been found, and the nitrate mineral accumulation includes Darapskites, Potasssaltpetrealum, Humberstonite, Nitronatrite and Niterite, etc^[7]. At the north-east direction (N 25° E), in surface layer of the salt shell in Aiding lake 120 km apart from the test area, some nitrate sediment have been found too, the nitrate mineral accumulation mainly includes Nitronatrite etc^[8]. Geology and Mineral Bureau of Xinjiang Uygur Autonomous Region in 1994 has taken spot sampling and component mensuration, which shows us that the concentration of nitric acid radical of the surface haloid water in Wuzunbulake saline is above 28.31 %.

According to this regulation, we can search modern nitrate deposits in downstream belt and proliferation belt of the air current in the test area. At present, there haven been several beneficial preparatory experiments and technical validation in the vast region^[9].

5.5 Atmosphere circumfluence

The atmosphere nuke explosion can affect the atmospheric circulation at height of 30 ~ 45 km from the ground^[10]. According to the temperature influence scopes of the nuke explosion process in Lop Nur test area, it can engender a high temperature air mass with diameter of 20 ~ 30 km above the test area. In short term, this influence could spread to downstream of the test area where the dry airflow would be strengthened, and the underlying drought area would be heated up, it would formed a warm character and high pressure area with localized vibration. And the influence to the peripheral atmosphere might be greater, and there would be saltant weather, dust devil or storms. In long term, it will make the aerosphere's configuration more unstable, catastrophic weather more frequent, airflow stirring more intense and its running rules more unascertainable. And this would aggravate the occurrence frequency of disaster weather and the disaster degree.

Some foreign scholars have ever estimated that once great deal of nuke explosion dust enter into the atmosphere circumfluence, it will bring a fearful aftereffect called "Nuclear Winter"^[11]. Chinese scholars have taken primary stimulation to the "Nuclear Winter" weather of China^[12]. The result of the stimulation indicates that once a nuke explosion in megaton grade occurred, a regional dry and cold "Nuclear Winter" would come forth. As a result, the air temperature and the precipitation would sharply fall and reduced.

5.6 Ground radioactive level

The nuclide radioactive contamination severely affects the organisms' survival, and this kind of harmful taint can exist for several decades even hundreds of

years. In short-term, any life activity is absolutely prohibited in the nuke explosion area. After over 40 years, the core area, a natural attenuating zone, is also inclining to the normal average level of radiancy in Lop Nur nuclear test area.

According to the investigation from the health and security department^[12], that they had spent 10 years (1974 - 1984) for monitoring and surveying the environment radiancy level in periphery region of the Lop Nur nuclear test area, the natural radiancies of these regions were near or slightly lower than the natural radiacy level of the region far away called nonpolluting contrast region. From the large-scale investigation about the radiancy level in Tarim Basin during 1988 - 1989^[13], we have not detected any nuclide contamination and high level radiation there. Various evidences point to the result that Lop Nur nuclear test area and its surrounding regions are now in a normal radiancy level^[14].

5.7 Climatic change

The comprehensive analysis of the effect on deeper stratum and the execution to the earth's surface during the nuke explosion in the test area, indicates that only one nuclear test actually can not have a long term effect to the climatic system, but the continuous and frequent nuclear tests is likely to intimidate the weather or climate process. The vestige of the crude water system and the process on the earth's surface in the test area shows that, there has been constantly great shower before the nuke explosion test in the test area, and then on the ground formed floodwater, which shattered the accommodation road. However, there has been no biggish rainfall in following 40 years in the test area, since the destruction on the ground and derelicts from the nuke explosion have not been eroded or moved, it means that no notable seeper has formed, and there has not occurred effective runoff process anymore. Integrating the long term change of rainfall and long term state of the ground streams with the intimidation action of the nuke explosion's remanent temperature effect, we can cognizance that, during the 40 years, the climate environment of the test area has been developing towards dry-hot gradually^[14].

6 Epilogue

Nowadays, nuclear diffusion and nuclear safety are still dangerous challenge in the world. There are some other nations definitely own to possessing nuclear exploitation technology and nuclear function equipments. All of these induce the international safety and the peaceful society facing a flinty trial again.

Not long ago, it was a high taboo area and a

spurned blank area of the environment change in the nuclear test area all over the world. Along with the technology advancing length by length, weaponization of the nuclear material and nuclear usage for energy sources greatly get synchronous developments. The nuclear safety and nuclear stratagem becomes a great sensitive problem in the international corporation and the common development. Both the nuclear fusion and nuclear fission can be achieved by human engineering technique under man's control. It is the common duty and common desire for human beings to utilize nuclear energy peacefully, to prevent nuclear accidents scientifically, to avoid nuclear disaster completely and to estimate the global environment response.

This production is based on the earth's satellite observation, remote sensing information analysis and comprehensive material researches. We only make a key anatomy and phase cognition about the typical test area and grope in this science foreland for the first time. If we made some contrastive analysis and synergic researches the two kinds of top class momentous projects by comparing the nuke explosion test area with the nuclear power station test area, it would contributed much more for us to scientifically cognizing that how to safely utilize the nuclear energy, how to prevent nuclear accident, and the relationship between resource, environment and harmonious society. In the end, we are looking forward to the naissance of new inter-discipline and fringe discipline, and hope this new innovative knowledge system would develop well.

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Author

Hu Dongsheng, male, born in 1951, professor, graduated from Northwest University, Xi'an, China. Mr. Hu has published over 70 papers. Now primarily engaged in the researching and teaching of the earth resources environment and the remote sensing geology and the earth dynamics analysis and the global change, etc. He can be reached by E-mail: hudsh@hunnu.edu.cn

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