

Radiation and Tribal Health in Jadugoda: The Contention Between Science and Sufferings

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INTRODUCTION

1. Development Paradigm and Tribal People

There has been a long standing confrontation between so called development paradigm initiated by the state machinery and the actual benefits gained by the tribal people in our country. Social scientists as well as social activists often cite instances in this regard. Most of the issues discussed so far are related to construction of major power plants, dams and industries in the tribal localities of the country and the consequent affliction of tribal people. The distressing part of the story is that such misfortunes have come up mainly after democratic governance took shape in the post independent India where the tribal domain is supposed to have the power of self-determination about their own life ways.

Studies have shown that major industrial projects, irrigation, power projects etc. have already displaced a lot of tribal people from their homes creating irreversible damages. Unfortunately, a large number of heavy industries, power generation cum irrigation projects and large scale mining operations had to be undertaken in the areas inhabited by tribal people due to the availability of required resources. Social scientists have found that displacement and disturbance in usual life ways invites some unique problems specific to tribal people owing to their aloofness, relative isolation, non-entrepreneurial nature and limited exposure to monetary economy and lack of social support.

The magnitude of displacement and problems of rehabilitation has been discussed widely by several scholars for a quite long time. Mahapatra (1997) has highlighted different aspects of displaced people and, citing Fernandez (Fernandez, 1991) he has shown that nearly 74,10,100 tribal people have so far been displaced as a result of development initiatives like Mines, Industries, Dams, Sanctuaries and other establishments. Among the total 21,00,000 displaced people due to mining operation, the

tribal people account for 12,00,000. The same source shows that the concerned authorities in the country have so far rehabilitated only 25 percent of the displaced tribal people.

2. Tribal People as Victims of Mining Industry

Mining as being the third largest industry in the world creates unwanted impacts on social, economic and environmental spheres in a society at large and the tribal people in particular. The Directory of Mines and Mine Areas published in 1976 by the Indian Bureau of Mines, shows that there were about 300 mine operations in Singhbhum district alone and more than 151,000 acres of land were leased out, owned mostly by the private agencies. Often the actual affected area is greater than what is shown in the official record. One of such operations is Uranium Mining. The impact of uranium mining in tribal areas is seen not only in socio-economic sphere but also in the sphere of health and well being of the ignorant and simple tribal people due to radiation.

2.1. Uranium and Radiation: Uranium is a metal and is found in the earth in extremely tiny proportions in the form of Uranium ore. The special characteristic that makes uranium distinct from all the other metal is its capacity to radiate. A substance is radiating means its atoms are exploding and throwing off pieces of themselves with great force. This process is called radioactive decay. During decay four major electrically charged particles are given off from Uranium atoms - alpha, beta, gamma and x-rays. More than 80 different chemicals can be released from fission of Uranium atoms. About 300 different radioactive chemicals are created with further chain reaction of each chemical. They are known as radioactive daughter products. All these chemicals are radioactive and have potential to cause ionisation. This process continues for a long time.

2.2. Non-ionizing radiation is various forms of electromagnetic radiation whose energy is not enough to cause ordinary substances to ionize,

i.e. to become electrically charged.

2.3. *Ionizing* radiation may consist of high energy electromagnetic radiation (X-rays, gamma rays) or of fast moving electrically charged particles such as protons, alpha particles and ions of heavy elements activated by various types of nuclear processes.

2.4. *Background Radiation*: Radiation not necessarily is emitted only from radioactive metals like uranium. Several sources of radiation are present in the environment. Radiation is a Natural Part of the Earth's Environment. It comes from the sky above us, the earth beneath us, and even from our own bodies. The air we breathe and the food we eat contain some naturally occurring radioactive materials. In our daily life, we are exposed to various types of naturally occurring radiation from cosmic rays, from radioactive substances in the earth, and from naturally occurring radiation in our bodies. This is commonly referred to as background radiation.

2.5. *Danger from Radiation*: Radiation is dangerous. For instance, Gamma ray is a form of pure energy, very similar to an x-rays, travelling at the speed of light. In the field of uranium mining the alpha particles are of great concern because most of the chemical emissions in uranium mining are from alpha particles. Alpha particles stay inside the body and continue their decay process damaging cells. These disrupt the cells' genetic functioning. It may lead to drastic fall of production of blood cells or cell alteration. Death of more red cells and proliferation of more white cells can cause leukemia. The Alpha particles may cause roughly 10 times more cell deaths and mutations and 3700 to 4500 ionizations per cell.

2.6. *Measurement of Radiation*: To assess the radiation related measurement two types of units are used, - units of activity and units of exposure (dose). Units of activity quantify the amount of radiation emitted by a given radiation source. Units of exposure quantify the amount of radiation absorbed or deposited in a specific material by a radiation source. In the world today, two sets of units exist.

A. Units of Activity

a. Special Units

Curie (Ci): The unit of activity for radiation is the Curie, abbreviated Ci. Most laboratory facilities use only millicurie (mCi, 0.001 Ci) or

microcurie (uCi, 0.000001 Ci) amounts of radioactive materials, since reliable data can only be obtained using low levels of activity for a given isotope. The Curie is an amount of radioactive material emitting 2.22×10^{12} disintegrations (particles or photons) per minute (DPM)

b. International Standard

Becquerel (Bq): The Becquerel is a unit used to measure a radioactivity. One Becquerel is that quantity of a radioactive material that will have 1 transformation in one second. Often radioactivity is expressed in larger units like: thousands (kBq), one millions (MBq) or even billions (GBq) of a Becquerels. As a result of having one Becquerel being equal to one transformation per second, there are 3.7×10^{10} Bq in one curie.

B. Units of Exposure

a. Special Units

The Roentgen (R) is the unit for measuring the quantity of x-ray or gamma radiation by measuring the amount of ionization produced in air. If human tissue absorbs one Roentgen of radiation, 96 ergs of energy will be deposited per gram of tissue.

Rad (Radiation Absorbed Dose): The rad is a unit used to measure a quantity called absorbed dose. This relates to the amount of energy actually absorbed in some material. One rad is defined as the absorption of 100 ergs per gram of material.

Rem (Roentgen Equivalent Man): The rem is a unit used to derive a quantity called equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Equivalent dose is often expressed in terms of thousandths of a rem, or mrem.

b. SI - International Standard Units

Gray (Gy): The gray is a unit used to measure a quantity called absorbed dose. This relates to the amount of energy actually absorbed in some material, and is used for any type of radiation and any material. One gray is equal to one joule of energy deposited in one kg of a material. Absorbed dose is often expressed in terms of hundredths of a gray, or centi-grays. One gray is equivalent to 100 rads.

Sievert (Sv): The sievert is a unit used to derive

a quantity called equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Equivalent dose is often expressed in terms of millionths of a sievert, or micro-sievert. One sievert is equivalent to 100 rem.

Some health effects of radiation are given in table 1.

3. Tribal Health Studies in India

Contrary to the vast range of eco-cultural distribution and differences there are only a few studies on tribal dealing with health, disease and treatment. These relatively scanty studies reveal that tribal-health maintenance system is attached with a lot of complexity intertwined with socio-cultural beliefs and practices. The concept of health of the tribal groups of India has not yet been properly defined. It has been observed that

the universal index of a threat to health is expressed through withdrawal from work. Mahapatra (1994), therefore, sees health among tribal groups as a functional, and not clinical concept. Sachchidananda (1994) sees the field of tribal health aspects as a cultural concept as well as a part of social structure and organization, which is continuously changing and adapting itself to changes in the wider society. Choudhury (1994) and Lewis (1958) believes that the study of tribal health should be with reference to their distinctive notions regarding different aspects of diseases, health, food, human anatomy and faiths as well as in the process of interaction with modern world. Singh (1994) indicates nine factors to examine and assess the tribal health situation in India. He highlights the effect of changing physical environment on tribal health as physical environment is ultimately related to their economic pursuits, nutritional availability, medicines etc. It has also been emphasized that

Table 1: Uranium ore constituents and diseases

<i>Chemical</i>	<i>Cancers</i>	<i>Other diseases</i>
Uranium *	(Lung, bone, stomach, brain and skin)	Kidney damage, birth defects, reduced sperm count, sin irritation, pulmonary fibrosis, liver damage and nervous system harm.
Radium *	Bone, nasal sinuses and mastoid air cells, leukemia, (eye, breast, liver, kidney and nervous system)	Bone and blood effects at very high levels, possibly cataracts
Radon *	Lung pulmonary fibrosis at very high levels	None
Thorium*	(Liver, bone, leukemia, pancreas, lymph, hematopoitic system and lung)	Chirrosis of the lungs, blood changes and altered liver enzyme levels.
External ionizing radiation	Acute and chronic myelogenous leukemia, lung, stomach, breast, (thyroid, bladder, nervous system, skin, oesophagus, colon, liver and bone)	Radiation poisoning at high levels.
Vanadium	None	Kidney, central nervous system effects (possibly including manic-depression), birth defects and inhibition of key cellular enzymes, cardiac palpitation and lung, skin and eye irritation. May be an essential nutrient at low levels. Investigated as a treatment for diabetes because it is an insulin mimic.
Arsenic	Lung, skin, liver, bladder, and (kidney)	Causes hyper-and hypo-pigmentation and hyperkaratosis of the skin. Toxic to the nervous system, can cause jaundice (liver) and can alter heart functioning. Causes peripheral vascular disease, blood changes, chromosomal aberrations and may lead to birth defects.
Magnesium	None	Neropsychiatric disorder (similar to Parkinson's disease), liver and lung damage. Decreased male fertility.
Beryllium	Lung	Lung disease (berylliosis) skin hypersensitivity, immunological changes, and kidney damage.

*= Radioactive element; () Scientifically weak association
 Source: Oral History and Photography (1999)

ecology and tribal health are intimately related. Studies of Barth (1956) and Fortes (1976) reveal how ecological niche influence people's health status. Khera's (1994) study among the tribes settled in Maikal hills of Central India shows that ecology plays an important, indeed dominant, role in creating structures of health and prosperity. Referring to the works of Basu (1986, 1989, 1990), Bardhan (1989), Roy Burman (1986, 1990), Swain et al. (1990), Mukharjee (1990), Sen et al. (1986), Mahapatra et al. (1990), Rizvi (1986), Mukharjee (1986), and Haq (1990), Basu (1994) reveals that widespread poverty, illiteracy, malnutrition, absence of safe drinking water and sanitary living conditions, poor maternal and child health services, ineffective coverage of national health and nutritional services are the possible contributing factors for dismal health conditions prevailing among the tribal people. Amidst the scanty data on nutritional problems of the tribal people Basu (1994) shows that nutritional anaemia is a major problem for women of tribal belts, especially for those who have many pregnancies too closely spaced, affecting the chances of child's survival. Maternal mortality was reported to be high among various tribal groups but no exact data could be collected. The chief causes of maternal mortality were found to be unhygienic and primitive practices for parturition (Basu, 1994). In these studies very striking phenomenon is that imbalance between traditional life-ways and the newly imposed ecological setting is the strongest deterministic factor in creating disturbance in tribal health sphere. The problem intensifies while the tribal people are not in position to control their environment and the competent authorities ignore their duties and liabilities. In recent years radiation related health hazards among the tribal people in Jadugoda has been widely discussed. While the local people and social activists in the area have been claiming the onslaught of peculiar health hazards relating to radiation effect from Uranium mining, the concerned authority's rejection of such charges makes the issue a controversy. In the following paragraphs it has been tried to depict this peculiar as well as controversial issue of tribal people in uranium mining area in Jadugoda.

URANIUM MAP OF INDIA

1. The Atomic Energy Commission (AEC):

The AEC, set up under the Atomic Energy Act in 1948, has overall control of all activities relating to commercial use of nuclear energy. The Department of Atomic Energy (DAE) was set up in 1954 and has full executive powers to implement the policies of the AEC. The Atomic Energy Regulatory Board (AERB), who is responsible to the AEC, formulates safety standards and regulations.

2. *Nuclear Power Corporation of India Limited (NPCIL)*: Formed in 1987 as the commercial arm of the DAE it is a wholly owned undertaking of the Government of India under the administrative control of the DAE. It designs, constructs, operates and maintains the country's nuclear power plants

3. *Uranium Corporation of India Limited (UCIL)*: The Uranium Corporation of India Limited (UCIL) was established in 1967 as a public sector enterprise, under the administrative control of the Department of Atomic Energy, with the objective of Mining and Processing of uranium ore to produce uranium concentrate. UCIL started its operations in 1968 at Jaduguda with uranium ore mining and a processing plant. The operating units under UCIL at present are: Underground Mines at Jaduguda, Bhatin Narwapahar; Ore Processing Plant at Jaduguda for producing Uranium concentrate, and Plants for uranium mineral recovery from copper tailings at Mosaboni and Rakha.

4. *Research Reactors & Other Nuclear Facilities*: Six research reactors are currently operating in order to develop nuclear technology and also to provide plutonium for nuclear weapons programmes. India is one of the few countries to still operate a fast breeder research reactor, the FBTR at Kalpakkam.

5. *The Safety Regulations laid down by DAE*: The Atomic Energy Act (of India), 1962 was enacted by the Parliament in the year 1962. The Act along with several other issues advocates some safety measures to be taken to protect people from harmful radioactive exposure. In its 17th Column under the title *Special provisions as to safety* the Act provides provision for safety for mine workers as well as common people within its operating areas.

FUNCTIONING OF JADUGODA URANIUM MINE

Before looking in to the controversy of

radiation related health hazards it will be worthy to mention some of the basic activities in UCIL's Uranium plant at Jadugoda.

Jadugoda has an underground uranium mine that was established in 1967. The Uranium Corporation of India who owns the Jadugoda mining supplies Uranium to the Indian Nuclear Industry and India's ten pressurized heavy water reactors. There are three underground mines namely, - Bhatin, Narwapahar, and Jadugoda from where Ore is taken and fed to the Jadugoda processing plant. At Jadugoda mining the concentration of ore is 0.06% mined at 1600-2000 feet below the surface of the earth. At the mill, ore is crushed to the powder and then chemically treated to separate the uranium. After the separation, the rest 99.94% of mined rock is left as waste.

The waste, commonly known as tailings, is treated with lime to neutralize the acidity and separated into coarse and fine particles. The coarse tailings are backfilled into the mine cavities. The fine particles are mixed with water and discharged into the tailing pond through pipes. There are 3 tailing dams that have been constructed on the agricultural lands of the tribal people. The first and second tailing dams have reached the state of saturation. The third one is likely to be filled up within a few years. UCIL is contemplating to construct fourth tailing dam at Tilailand that will displace the entire village with more than 200 families and fertile agricultural lands.

The present study contains the finding of a very brief field investigation about the health-related aspects of the people in Jadugoda. It also contains some relevant secondary data collected from different sources in support of those claims and disclaims regarding radiation and health related issues.

THE INSIDE STORY OF URANIUM MINING AND TRIBAL PEOPLE IN JADUGODA

1. Uranium Mining and Tribal Sufferers in Jadugoda: Chotanagpur plateau, where Jadugoda situated, is one of the richest areas in natural resources in India. It has huge reserves of minerals like coal, iron ore, mica, bauxite, limestone, copper, chromate, asbestos, kyanite, china clay fire clay, steatite, uranium, manganese, dolomite, tungsten, gold etc. The Singhbhum

Copper-Uranium belt contains largest deposits of copper and uranium in the country today.

Chhotangpur is the third largest concentration of tribal population in India with overwhelming majority (91.71%) in late eighties (Singh, 1986). Presently the Mundas, Santhals, Hos and the Oraon are numerically major tribes in Chotanagpur. These tribal groups also differ widely among themselves in terms of the level of socio-economic development and transition.

The Santhals are believed to be amongst the earliest inhabitants of India (Singh: 1986). Their earlier homeland was the Chhotanagpur plateau and the surrounding plains South of the river Damodar. The Santhal migration started after the 1770 A.D. famine into Birbhum and Santal Pargana, which is their present homeland (Singh, 1998). However still a substantial number of Santhals are spread over different places.

The Santhals, who were traditionally hunters and food gatherers, have been gradually transformed in to settled cultivators. Agriculture is their principal occupation: more than two third of the population are engaged in cultivation and one fourth as agricultural labourers. They have a deep relation with nature. They believe that the nature move in a cyclic order and results seasonal changes on the faces of the earth (Hembrom, 1988).

The Ho tribe is concentrated in the Kolhan area of Singhbhum district of Jharkhand. They also inhabited the adjacent areas of Orissa, West Bengal and Madhya Pradesh. Hos are divided into a number of totemic clans. They migrated from Chotanagpur due to invasion of Oraons and occupied Kolhan upland by driving away the Bhuiyas and other tribal groups. Now they are settled cultivators though to a great extent they depend on other occupations also to supplement their livelihood. A relatively higher proportion of the Hos work force of Singhbhum district depends on mining and industrial activities in Noamindi, Gua, Jadugoda, Jhinkpani, Musabani and Jamshedpur.

Jadugoda Uranium mining and plant has been built on the land once happened to be of tribal people. The village of jadugoda was acquired 35 years ago to construct the processing plant, mining and the staff quarters. According to a rough estimate the Uranium Corporation of India Limited at Jadugoda acquired 2,000 acres of land. The township of Jadugoda was established displacing 5 villages. According to the 1961

census the total population of these villages was 2,047 of whom 47.1% were tribal. Many indigenous tribal families have been displaced from their ancestral land owing to the construction of mines and mills at Bhatin, Turamdih and Narwapahar. Neither they have been properly resettled nor have they received full compensation for their land. Many of them live along railway lines and roadsides near Sundernagar area.

The most recent incident of eviction was on 27th of January 1996. It was learnt from the local people that they were not warned or informed through prior notification for such an act. All these works were carried out under the heavy security provided by the CRPF, CISF and Bihar State Police Force. Years back in 1985, UCIL had served notice to the villagers of Chatikocha that their land would be acquired to construct a third tailings dam. In 1994 people were asked to come and collect compensation. Families affected felt humiliated by the pitiful compensation offered, and refused to accept. Instead, they presented a set of demands that were disregarded.

2. *Emergence of Awareness About Radiation Related Health Hazards at Jadugoda:* The people of Jadugoda at first accepted the UCIL's Uranium plant as an opportunity for waged work and means of quick progression towards modern amenities in their locality. If one ignores the issue of losing their land and forest in this process, people by and large welcomed the plant as a means of their livelihood in new circumstances. Thus they were oblivious enough about the impending danger of uranium radiation.

From the brief visit to the field it was apparent that the UCIL authority did not take any effective measure to keep people away from the tailing ponds in past years. People used to tread through these tailing dams to the forest; children used to play football there, cattle grazed cheerfully and people used to catch fish in the water bodies in the pond. Dust moved freely with winding weather towards the unprotected villages all around. Thus from the beginning of the plant till the intervention of the JOAR (Jharkhandi's Organization Against Radiation), which was established in the year 1991, people here did not know what is what.

It was in the year 1991 when world Uranium Hearing started and the literature was sent to MMP (Mines, Minerals and People) from where the JOAR came to know about the virulent

situation in Jadugoda. Hence, along with awareness campaign the organization conducted a survey in the year 1998 in Jadugoda. The survey revealed that the women folk in that locality have been suffering from certain reproductive health problems which may be caused by radiation effect. For instance:

- * 47% women reported disruptions during their menstrual cycle
- * 18% women suffered miscarriages/ still birth in last 5 years
- * 30% reported some sort of problem in conception
- * Majority of women complained of fatigue, weakness and depression

The local activists are also of the opinion that higher incidents of chronic skin disease, cancers, TB, bone and brain damage, kidney damage, nervous system disorders, congenital deformities, nausea, etc. May be related to unchecked radiation in the area.

Interaction with local people of the area reveals that transparency is not maintained by the UCIL authority regarding the amount of dose a person receives per day. Whenever a miner falls sick, he is never told about the clinical report. He just receives routine medicine from the UCIL hospital without knowing the real happenings. Ghanashyam Biruli, a local level social activist is of the opinion that all major internal diseases the people have are labeled as T.B. only. The medical reports are kept as closely guarded secret. UCIL also dismissed labourers who showed sign of illness. It also took recourse to private labour companies to hire contract labourers.

The local people say that the UCIL authority conducted a health survey headed by District Civil surgeon. It identified 31 people including women and children said to be affected by radiation. It was said that they would be treated at the UCIL. Villagers complained that they were given a token and asked to show at the hospital for treatment. When they went there they were chased away by the hospital authority saying that it was not they who have identified them.

THE REASON BEHIND THE WORRY

1. *The Linear No-threshold Theory (LNT):* The worry about radiation effect on health in a low radiation zone grew in to a major concern for people on the basis of the proposition that no level of radiation is safe for living beings. The controversy regarding the effect of low level

radiation (LLR) on human body has been getting popularity among common people, especially in connection to the uranium mining and operation of nuclear plants. The issue of LLR can be stated in a simple way as follows:

Conventionally, the cancer risk from LLR has been estimated by use of the linear no-threshold theory (LNT). For example, it is assumed that the cancer risk from 0.001 Sv (100 mrem) of dose is 0.001 times the risk from 1 Sv (100 rem). In recent years, the former risk estimates have often been reduced by a "dose and dose rate reduction factor" which is taken to be a factor of two. But otherwise, the LNT is frequently used for doses as low as one hundred-thousandth of those for which there is direct evidence of cancer induction by radiation. It is the origin of the commonly used expression "*no level of radiation is safe*" and the consequent public fear of LLR.

The principal basis for the LNT is theoretical. A single particle of radiation hitting a single DNA molecule in a single cell nucleus of a human body can initiate a cancer. The probability of a cancer initiation is therefore proportional to the number of such hits, which is proportional to the number of particles of radiation, which is proportional to the dose. Thus, the risk is linearly dependent on the dose; this is the LNT (Cohen, 1998)

The problem with this very simple argument is that factors other than initiating events affect the cancer risk. Our bodies have biological defense mechanisms (BDMs), which prevent the vast majority of initiating events from developing into a fatal cancer. There is plenty of very direct and obvious evidence on this. For example, the number of initiating events is roughly proportional to the mass of the animal; more DNA targets means more hits. Thus, the simple theory predicts the cancer risk to be proportional to the mass of the animal. But experience indicates that the cancer risk in a given radiation field is roughly the same for a 30 gram mouse as for a 70 000 gram man, and there is no evidence that elephants are more susceptible than either.

If only the number of hits (which is proportional to the number of initiating events) were relevant (regardless of the mass of the target), then the very definition of dose in terms of radiation hits per unit mass of the target would be misleading. Another obvious example of the failure of the simple basis for the LNT is in the spectacular increase in cancer incidence with age. Young people experience cancer-initiating hits as

frequently as old people, but the probability for a cancer to develop is much higher in old people. There is a substantial body of data, both on animals and on humans, indicating that the latent period between radiation exposure and cancer death increases with decreasing exposure. Elaborating the earlier references of Cohen B.L. on this topic Raabe O.G (1994) shows that for low exposures, the latent period of developing cancer exceeds the normal life span, so no actual cancers develop. Thus, there is an effective threshold. This effect alone, even in the absence of all considerations discussed previously, would invalidate the LNT for LLR.

Likewise Pollycove (1998; c.f. Cohen, 1998) observes that DNA damage events at 0.1 Sv of radiation, which approaches the upper limit of LLR, causes only 200 breaks per cell as against 150 000 per day in each of the trillion cells in our bodies due to chemical and other spontaneous processes. It thus seems clear that cancer-initiating events are of negligible importance in determining the dose-response relationship for radiation carcinogenesis in the LLR region. Apparently, the principal effect of radiation in causing cancer is from modifying BDMs, rather than from providing initiating events. Thus, the simple basis for the LNT has collapsed.

Contrary to the general belief of LLR effect, researchers have shown that the number of chromosome aberration (a type of genetic damage due to high level radiation) is substantially reduced if the high dose of radiation proceeded by a low dose 5cGy radiation (Shadley and Dai, 1992; c.f. Cohen, 1998).

Since the immune system is important in resisting the development of cancer, the effects of LLR on it are relevant here. Liu (1992; c.f. Cohen, 1998) lists the effects of LLR on several different measures of the immune response. He shows that by each of these measures, the immune response is increased by LLR. Makinodan and James (1990; c.f. Cohen, 1998) reports increases in immune response by 80% in vitro and by 40% in vivo at about 20 rad followed by a rapid decrease to well below the unirradiated level at doses of about 50 rad.

All of the works reported in this section suggest that LLR is protective against cancer; quite the opposite of what is expected from the LNT. Not only has the simple basis for the LNT collapsed, but also there is a large body of evidence indicating that a more complete

treatment of the problem would show a decrease in risk with increasing dose in the low dose region. However, final decisions on dose-response are always most heavily weighted on experiences with exposures to humans.

CONFLICT BETWEEN PEOPLE'S PERCEPTION AND CONCERNED AUTHORITY

1. The Stand of DAE on Radiation Level: Regarding the radiation level of the operation area the DAE says that radiation survey of the area around Jaduguda was conducted by scientists from BARC and they have concluded that the operations undertaken by UCIL in the Jaduguda environment have not resulted in any increase in the natural background radiation levels beyond the level prescribed by Atomic Energy Regulatory Board. The background radiation prevailing at Jaduguda is about 1179 uGy/year, which is about the same level as observed in other parts of East Singhbhum District, e.g. at Jamshedpur it is 1150 uGy/year and at Ghatsila it is 1226 uGy/year. The limit of radiation exposure for general public is 1000uGy/year over and above the natural background radiation.

2. UCIL's Stand on Radiation Level: The UCIL authorities have claimed that as far as effluents from UCIL operations are concerned, they are treated fully before they come in contact with the local aquatic stream. Mine water from all mines is collected, clarified and re-used in ore processing plant. Tailing pond effluent is clarified and a part of this is sent to the plant for re-use. Rest is retreated, clarified, settled and precipitates are sent to tailings pond. The clear effluent is monitored and is clean enough to be discharged to the environment. With implementation of the Effluent Reclamation Scheme (ERS) the fresh water consumption for industrial use has gone down. Ore mining and processing, like any other industrial activity would have some impact on the environment. Efforts are made to ensure that the effect on environment is minimum and remains below the specifications provided by national and international expert bodies.

To achieve this objective, at Jaduguda, an

independent Health Physics Unit regularly monitors the concentration levels and discharges, if any. It ensures that the activity is not polluting the environment. The Environmental Survey Laboratory collects the environmental samples for analysis for surveillance of environment.

It has also been mentioned that the concentration of uranium in Gara Nala, Subernrekha river and Gara river have been always found to be less than the limits set by AERB and World Health Organization.

3. The Stand of DAE on Radiation Effect in Jadugoda: Contrary to the huge cry of JOAR and other social activists and organizations regarding health hazard the Publicity Division, Department of Atomic Energy, Government of India states that most of the articles published in news papers and other print and electronic media regarding ill effect of radiation are not based on scientific facts. The same statement claims that the department has commissioned two independent surveys in the villages around Jaduguda. The first one was done by the faculty from Radiotherapy and Radiology department of the Patna Medical College. In their report they say that the radiation emission in the areas were well within the tolerance limits and also that none of the villagers from these villages have mentioned any problem to them related to radiation hazard. The second survey undertaken on request from the Bihar Government covered inhabitants residing within 2 km radius of the tailing pond. The medical team collected data from seventeen settlements from 8 villages. Around 3400 persons were examined and 31* persons were short-listed for further investigations. Detailed clinical examination of the short listed persons was also carried out. Subsequently, these cases were reviewed by a team of experts comprising medical and radiation safety personnel from BARC, UCIL, nuclear medicine specialists from Tata Main Hospital (Jamshedpur) and doctors from Bihar Government including the Civil Surgeon of Singhbhum (East) District. After a detailed review the team was convinced and unanimously agreed that the disease pattern cannot be ascribed to radiation exposure in any of these cases. The report clearly stated "... thus the consensus of all the doctors was that the cases examined had congenital limb anomalies, diseases due to genetic abnormalities like thalassemia major and retinitis, pigmentosa, moderate to gross splenomegaly due to chronic malarial infection (as this is a hyperendemic area)

*This is to be mentioned that these 31 persons went to Hospital afterwards carrying the tokens they received from the investigation team. The people said that they were denied any further treatment by the hospital saying that the hospital authority is not responsible for their treatment.

malnutrition, post encephalitic and post-head injury sequel". The medical survey by specialists did not identify any patient suffering from radiation related diseases. Here it may be worthwhile to note that while the Indian Council of Medical Research (ICMR) has estimated the national average incidence of cancer to be 74 per one lakh population, in Jaduguda the incidence is only 22.

4. *Other Medical Team's Statement:* A team of doctors (4 members) forwarded the same sort of opinion. After receiving several complaints regarding increasing health hazards in the adjoining villages of UCIL due to radiation, the Jharkhand Government had dispatched a letter to the East Singhbhum district administration directing the DC to initiate an inquiry by a medical team and send the report as early as possible. The medical team comprising Dr K K Singh, Dr Balram Jha and Dr Preeti Mohan Sahay accompanied by an executive magistrate Dr M K Jaiswal, noticed that there were hardly a few cases of deformities in the local area. The team also made very aggressive comment that there are certain elements who, for their vested interest, collect disabled children from far off places and relate them with radiation cases.

5. *Health Status of Children in Different Level of Background Radiation:* A collaborative scientific study on new born children in low and high background radiation areas of Kerala, was conducted by BARC and the Directorate of Health Services of the Kerala Government. Under the study, over 60,000 newborn babies have been scanned so far in the areas having significant population density. The natural background radiation exposure rate in the areas covered in this study varied from 1.15 to 35 milligray per year. The frequency of malformation (1.53%) in the total live births examined from this area are found to be comparable with similar studies done on nearly 72,000 new borne in Chennai (1.6%), 95,000 new borne from New Delhi (1.46%), Baroda (2.05%) and Mumbai (2.3%). The results of this study have been published in the journal 'Radiation Research Vol. 152'. It is important to note that background radiation exposure rate in the Jaduguda area (1.1 milligray per year) is quite less as compared to the average radiation dose in the high background radiation area of Kerala (*Radiation Research* Vol. 152). This study has shown no significant difference in any of the reproductive factors such as congenital

malformation, stillbirth or twinning, between the two groups of new borne. The congenital malformations occur the world over and the occurrence is known to be due to several factors such as maternal age, consanguinity, ethnicity, nutritional status etc.

THE CONCERNS AMONG THE LOCAL PEOPLE

The experience in the field, however, points out something hitherto unknown reasons for these ailments. In Tilaitand a 30-year-old miner has a son named Rohit who is living with a serious blood disorder. Pahari Oram has 7 children two of whom figured the list of Jadugoda's victim, 12-year-old son Dhaniya and 14-year-old Alobati. Their ankles and knees are twisted and contorted from birth. Mangal Soren, a JOAR activist who conducted the survey of Jadugoda's children had identified 160 children from Tilaitand, Chatikocho, Ichra, Mechua, Bhatin and Dugridihi who were suffering from deformity and one or the other diseases. He says that many of them died within 2 months from birth. Table 2 shows the number of young people who are identified as the sufferer from one or the other ailments that people think to be radiation related. The data in the table show that deformity is very much prominent among the young people in the area. People usually curse their fate for such occurrences while the enlightened people blame the radiation effect from UCIL. People say that such ailments were not so widely known during past years.

Table 2: Types of ailments prevalent among the younger people in and around Jadugoda, 2000

S. No.	Disease/disability	Number of children	Percentage
1	Disabled & crippled	38	74.5
2	Mental disorder	5	9.8
3	Physical & mental disable	5	9.8
4	Eye weakness	1	2.0
5	Megacephalli	1	2.0
6	Thalassemia	1	2.0
Total		51	100.0

Table 3 shows the ailment pattern among young people concerning their age groups. The table reveals that disabled and cripple cases are more in number among the young people aged up to 20 years. People tend to relate this phenomenon to the new exposure to radiation due to rapid mining and disposal of tailings by the UCIL in recent years.

Table 3: Age wise distribution of diseases/ailments in and around Jadugoda: 2000

<i>Diseases</i>	<i>Age group in years</i>					<i>Total</i>
	<i>1-4</i>	<i>5-10</i>	<i>11-15</i>	<i>16-20</i>	<i>21-30</i>	
Disabled and crippled	7	13	10	6	2	38
Mental disable	1	1	3	1		6
Physical and mental disable	2		3			5
Megacephali		1				1
Thalassaemia	1					1
Total	11	15	16	7	2	51

Observing this table it becomes clear that the growth abnormality is in vogue in the area. Disabled and crippled children are more in number compared to other forms of diseases. Among the affected children male are more in number.

There have been growing instances of children being born deformed and dying after few hours of birth. It is learnt that most of such occurrences go unreported. Many parents have refused to permit to take photograph of their babies. In September 2000 Robon Majhi from Mechua had a son born. The baby's stomach was without skin cover and it died immediately after birth. Bamkim Kalaindi's son had unusual head structure. The whole face was upward. It also died just after the birth. The village *dhai* of Mechua who attends to the delivery cases revealed that she attended to (and had knowledge about) miscarriage cases more than the cases of live birth she attended. The village nurse also told that she had attended to many delivery cases where there have been still births. The common belief of tribal people describes it as the consequences of omen of evil spirit or as the result of going to the forbidden place, touching forbidden things, dreaming evil dreams etc. The intensive awareness campaign launched by JOAR is making the tribal people understand about the impact of radiation to certain extent.

Basant Mukhi is a well-accepted village *dhai* in Tialitand. She has just started her profession inheriting from her mother. Within this short period of experience she attended to quite many delivery cases and according to her most of the complicated cases ended in a stillbirth. Often others do not know this fact as couples try to suppress such incidents. It was observed during the field investigation that the most often discussed issue among the women during their gathering is regarding their menstrual disorders. The incidents of reproductive disorders are also

reported in UCIL colony. It is commonly believed that as the residents of UCIL colony are employees of the company they cannot openly speak about this problem openly.

THE PRESENT STUDY

To conduct a controlled comparative study two localities namely, - Jadugoda and a village called Bara Goira, 50 km away from Jadugoda, inhabited by the same community were selected. The distance factor was taken to nullify the so-called radiation effect among the people. Villages covered in Jadugoda are Chatikocha, Tilaitand, and Dungridih. The sample size constituted 56 households covering 377 persons. From Bara Goira village the sample size was 50 households encompassing 314 individuals.

Primary field data were collected from these two places to examine the validity of claims made by the UCIL authority and investigating team regarding occurrence of diseases in Jadugoda. It has already been mentioned that they have identified people's life-style, drinking habit, environment and genetic disorder as the main factors for such ailments.

The two localities are different in terms of amenities to health care and modernity. While Jadugoda is equipped with health care centres and available markets, the Bara Goira people have to cross a distance of six kilometer for the same. While most of the people in Jadugoda are engaged in some sort of income generating activities in and around UCIL, only 10 percent of Bara Goira people have such fixed income sources. Thus poverty is rampant in Bara Goira.

In Bara Goira all the people are cultivators. Due to lack of irrigation facility the crop is totally depended on the rain and hence they rely on single cropping. Compared to the people in Jadugoda the income level of Bara Goira people is lower. People in Jadugoda mostly work in the

mine and their income is stable. In Bara Goira people depend on minor forest produce too. The food habit is same as the people of Jadugoda. Drinking country liquor is common among the tribal people of the village. Even the younger people were found drinking. There are 5 huts where country liquor is sold. All those who return from a day's work have a drink every day. It was known that women folk did not suffer from menstruation problem as frequently as the Jadugoda women did. The hospital is far away from the village. Hence the village nurse would attend to the delivery cases. Throughout her working years there were no cases of stillbirth and deformity of children in Bara Goira unlike the incidents rampant in Jadugoda.

The propositions formulated for the study were as follows:

1. Poverty effects nutritional status hence Bara Goira people must be suffering more in terms of similar ailments compared to the people in Jadugoda.
2. Being the same stock of population genetic deformity should be similar and should be expressed equally through phenotypic diseases.
3. Being the same community and hence following the same life-style and tradition there should be same sort of consequences in terms of health seeking behaviour.
4. As the habit of drinking liquor is seen more in Bara Goira the related ailments must be more as compared to the people of Jadugoda.

On the basis of these propositions the study was conducted and the findings are given below in tabular form.

In Jadugoda, among of 377 persons surveyed 66 persons were reported to be having some sort of diseases. The types of diseases are shown in the Table-4. The table clearly shows that reported cases of TB among the people are quite high. This also supports the opinion of the activists in the area that any internal disease is termed as TB by the competent authority in Jadugoda.

When the same cases were tabulated (Table 5) according to the sex difference it becomes evident that the number of affected persons especially in case of TB are far greater among the males. One of the reasons of such disparity may be due to the fact that the cases of women are usually remain unreported due to several socio-cultural factors.

Table 4: Number of persons suffering from different ailments in the villages in and around Jadugoda: 2000

Diseases	Number of person affected	Percentage
TB	24	6.4
Cancer	1	0.3
Frequent fever	5	1.3
Body pain	7	1.9
Menstruation problem	2	0.5
Deformity	3	0.8
Chest pain	3	0.8
Hydrosol etc	7	1.9
Skin disease	5	1.3
Brain damage	2	0.5
Died after birth	2	0.5
Barren	4	1.1
Leg swollen	1	0.3
Total	66	17.5

Table 5: Sex wise occurrence of health problems among the people in and around Jadugoda

Health	Male	Female	Total
TB	22	2	24
Cancer	1		1
Frequent fever	3	2	5
Body pain	6	1	7
Menstruation		2	2
Deformity	1	2	3
Chest pain	3	-	3
Hydrosol etc	7		7
Skin disease	2	3	5
Brain damage	2		2
Died after birth		2	2
Barren		4	4
Leg swollen	1		1
Total	48	18	66

Table 6 shows that the numbers of people suffering from same ailments are very few in Bara Goira. The investigation does not show any disabled children in the village. The number of people suffering from TB is also very little in number: 1.3 percent compared to 6.4 percent in Jadugoda.

The UCIL authority tends to blame the drinking habit of tribal people for their ailment. Survey was made to establish a relationship between drinking habit and ailments in both the villages. Table 7 shows the number of people suffering from one or the other diseases according to their drinking habit. Here people who used to drink three days or more a week up to a level of drunkenness prior to their ailments are grouped in first category (drinker).

The table, in fact, shows no significant cause-

Table 6: Occurrence of disease in Bara Gorla: 2000 (N=314)

<i>Disease</i>	<i>No. of persons</i>	<i>%</i>
Body ache	5	1.6
TB	4	1.3
Joint pain	7	2.8
Menstrual	1	0.3
Skin disease	2	0.6
Chest pain	2	0.6
Paralyses	2	0.6
Weakness	1	0.3
Total	23	7.32

Table 7: Occurrence of ailments according to drinking habits of people in Jadugoda: 2000 (N=50)

<i>Types of ailments</i>	<i>Drinker (%)</i>	<i>Non-drinker (%)</i>	<i>Total (%)</i>
TB	18	30	48
Body pain	6	8	14
Frequent fever	4	6	10
Chest pain	2	4	6
Skin Disease	2	8	10
Hydrosil etc	8	6	14
Total	40	60	100

effect relation between heavy drinking behavior and ailments prominent in the area. As it was found that among the surveyed people in the two villages, the people in Bara Gorla have lesser number of such diseases in spite of the fact that they drink more, the very allegation that drinking habit is primarily causing ailment doesn't stand for validity.

IMPACT OF URANIUM MINING ON SOCIAL LIFE OF THE TRIBAL PEOPLE

The socio-cultural life of the Hos and the Santhals in Jadugoda have gone through a series of changes since the mining came into operation influencing their occupation, social structure and also in cultural aspects.

Most of the tribal people lost their fertile land to the uranium plant. These people were simply turned into unskilled waged laborers as compensation to their lost, having no bargain power and decision-making power of their own. This sudden change in occupational pattern had a far-reaching impact in their social structure. As the very basic social cohesion through traditional occupation disappeared under new monetary economy, people started losing their cultural moor

and social integrity as whole. The fall of tribal god can be seen from the following live example.

Tribal people consider forest as a sacred place because their ancestral deity resides there in *Zahira* — a thick Sal tree plot. People pray and worship here for good rain and harvest and for protection from natural calamities. Close to Dumridih and Chatikocha on the side of the mountain there is a *Zahira* where people still go for worship. Now the tailing ponds of UCIL have embraced some land dedicated for *Zahira* giving a mental stress to the tribal people of the area. The regular worship was hampered with the construction of the third tailing pond. Now three tailing ponds surround the place of worship. When the third tailing dam gets filled up *Zahira* will also be submerged. Submersion of the worship place would mean the ruthless attack on the tribal faith, a blow to the very existence of the tribal people.

Forest contributed a substantial portion of livelihood for the tribal people. All minor forest produces would supplement them with agriculture. There was no botheration whatsoever for the need to go to the market. The increased population pressure due to arrival of the UCIL and its construction activities etc have reduced the forest cover of the area creating difficulty among the tribal people.

The water bodies, the lifeline of the tribal people have also been affected a lot. For instance, the Runkini river where people used to take bath, draw water and catch fish has been turned in to a small drain due to UCIL's dumping activities. There was a big reservoir where water remained all through the summer. The people of Dumridih alleged that the reservoir was gradually filled up by UCIL with rocks and other wastes. They say it was a strategy of UCIL to remove them from the place by creating water shortage. People began to face problem once the river became narrow and shallow. Dumridih, Chatikocha, Tilaitand did not have water supply facilities and people were forced to drink contaminated water for long. Water supply was set up for Chatikocha village only after putting strong demands by village people.

Migration of tribal people from their land to other places and the influx of non-tribal people in to tribal domain seeking jobs etc have created social imbalance and adjustment problem. The original inhabitants of Jadugoda where the mining, mill and UCIL colony stand now have long back left the place in search of livelihood.

They are not traceable now. At that time the problem of displacement did not receive much attention as the land was somewhat available. With the progress of UCIL work, many labourers came for employment. Jadugoda now have people from different castes and communities. The out migration of tribal inhabitants has resulted in decay of several age-old customs and traditions. The researcher's interaction with the young people reveals that they are unaware of many traditional cultural aspects. During the last 3 decades there have been gradual decline observing the festivals, celebration, marriages etc. They hardly find or realize the values and importance of age-old traditional events.

In Jadugoda the tailing dams have been constructed on the fertile paddy fields surrounded by the Green hill. The villages are very close to the dams. Chatikocha and Dumridih villages are just 40 and 60 meters away from the tailing dam, Mechua, and other villages are in between the Rakha Railway station and tailing dam. The wind can easily spread radon gas across villages and pollute the air. The tailings dust flies to the vast areas of agricultural land of Subarnarekha valley.

PEOPLE'S RESISTANCE TO EXPLOITATION

There are several instances of people's resistance against radiation hazards all over the world in the recent years. It has been observed that with the booming up of nuclear industry all around the world, indigenous people have suffered at disproportionate higher rates than any other population. In India it is the Santhals and Hos at Jadugoda taking the risk of their lives for the nuclear development of the nation. The studies have clearly shown that the authorities were not at all transparent in terms of safety awareness building among the people and also in most of the cases basic preventive measures for pollution safety were not followed.

The indigenous people's organization JOAR (Jharkhandis Organisation Against Radiation) was set up in 1991. It has taken up several activities against the negligence of UCIL authority along with awareness campaign among the people in Jadugoda. These people approached the Ranchi Bench of the Bihar High Court in mid 1996 seeking to stop UCIL from destroying their village completely. The court directed the villagers to have a dialogue with the management. During

series of meetings the people stuck to their demand. In the course of time the following points were agreed upon

1. The UCIL management and the District administration agreed to provide free house-sites to each displaced family in a plot to be acquired by the government and set up the needed infrastructure facilities such as road, water, electricity etc.
2. Rs.65,000 (45,000 from UCIL and 20,000 from the government) will be given to each displaced family to construct a house of their choice within this amount.
3. Every male adult above the age of 18 of all the displaced families will be given permanent employment in UCIL.
4. UCIL agreed to identify those persons who have been affected by radiation and treat them at its own expense.

So far as implementation of these demands are concerned very little is credited to the success story of the organization and the people.

In 1999 independent media producer KRITIKA made a 55-minute documentary "Buddha Weeps in Jadugoda" (Ragi: Kana: ko Bonga Buru). It has depicted the Adivasi life style and the way the people are affected the mining activities. It is being used to bring awareness among the people. It also discloses the baseless claim of UCIL authority about safety measures taken in tailing ponds.

SUMMARY

The foregoing discussion has clearly shown that people in Jadugoda have been facing a controversial issue of health. It is also evident that while the controversy is so rampant, the fact-finding studies are not satisfying at all in terms of coverage and intensity. Due to lack of in-depth and systematic scientific study of population exposed to radiation, one cannot exactly pinpoint any cause-effect relation between diseases and radiation. However, from the studies so far undertaken it has been seen that there are many kinds of diseases reported from the studied area similar to those caused by higher dose of radiation, e.g. birth defects, cancer, leukemia, tuberculosis and immediate death. When elders testify that the present phenomena of health hazards were not there 30 years ago, one is compelled to give it a serious thought. With the increasing number of deformed children being

born (many of them die soon after the birth), women experiencing reproductive problems in large-scale etc, it is apparent that there is a great danger to tribal health. Besides, the proximity people have to the tailings and in the atmosphere in which they are living itself is a threat to their life.

While the scientific studies (including LNT) and concerned authority deny the effect of low level radiation on health the comparative study and observation between villages at Jadugoda and Bara Gorla shows that the people of Jadugoda are, to a great extent, paying the price for the country's Nuclear development. It clearly shows that the reasons provided by the UCIL official for the diseases (drinking habit, malnutrition, and superstition) do not hold true. It is only a way to wash off their hands from the responsibility.

Coming to the issue of displacement it can be said that there is a gross violation of human rights. The displaced people have not yet been rehabilitated properly. The lack of interest of UCIL towards welfare of tribal people is condemnable. Having annihilated the source of livelihood, UCIL has not provided that locals with total employment. The basic need like water is also not provided to the villagers and they are forced to drink the contaminated water. The UCIL did not do anything towards public awareness regarding adverse effect of radioactivity. They did not take into consideration the local people's day-to-day activity, their economic activities, and their relation to the hills, forest, and rivers and so on when the tailing dams were constructed. As a result, the tribal people are still treading through these dangerous areas. Their cattle graze there without reverence. The UCIL authority finished its duty of public safety only by putting a signboard in the tailing pond: the meaning of which, naturally, could not be understood by the unlettered tribal people.

The socio-cultural life of the people is also affected leading to drastic change. People are facing psychological vacillation due to fear of radioactivity (or generally believed evil spirits). Another striking feature is that the UCIL, to a great extent, neglected the security of people and management of tailings disposal. In 1981 the Dumridih dam [Jadugoda] burst, the effects of the spill will never be known. Nichia village lies at the bottom of the dam. UCIL tried to repair the damage with bolder reinforcement. UCIL has been

constructing these dams, on the paddy fields of the Adivasis. While their fields are being requisitioned, their residential plots are not, thus compelling the villagers to live beside the dam. In Jadugoda, Villages like Chatikocha, Tuar Dumri, and Bara Dumri are just below the tailing dam. Tailing ponds have been showing cracks which are being filled with the mud and boulders. Who can guarantee the safety of the embankment? If accident happens the amount of radioactive pollution will be inconceivable.

CONCLUSION

To assess the possible health hazards caused by radiation there is a need of precise and advanced scientific knowledge and infrastructure. Issue like effect of radiation from Uranium has remained highly strategic as it is directly related to the question of national security. For obvious reason, the UCIL authority closely guards the occurrences whatever it may be. It is worthwhile to mention here that the researcher had certain limitations constraints including time, finance, access to official information. Moreover, the people of the studied area were not willing to disclose the incidents in the fear of action taken by the UCIL authority. However, having met with the people and some of the UCIL officials and having witnessed the people suffering from ailments and psychological insecurity there, the researcher had ample reasons to believe that there is drastically something wrong. This is a reality every one can see.

For logical argument let us take for granted the statement of UCIL as to be true. According to them there are no health-related problems due to radiation from uranium mining and processing. The health problems people facing are related to their lifestyle, i.e., drinking liquor, nutrition, excessive hard work, and unhygienic condition. Contrary to their statement, it can be said that the people did not have the history of such illness and disease prior to the working of UCIL. After the acceptance of job in UCIL the people here in Jadugoda live a better life compared to other tribal people in the area. Drinking habit of tribal people is not a new and non-traditional phenomenon. A lot of their ritual observances are related to offering of liquor. After the establishment of hospital the people are also becoming familiar with the requirement of health checkup of women during pregnancy. Obviously, there should have been lesser cases of miscarriage and abortion etc

compared to past years. The analyzed data of the controlled group, that is, the people of Bara Gorla have shown a favorable lifestyle and condition towards occurrence of disease similar to the statement given by the UCIL authority. But the extent of diseases similar to those suffered by Jadugoda population, is far below the expected level. In many cases certain ailments like disabled and crippled children are not at all reported in Bara-Gorla despite the fact that in terms of genetic traits (same tribal group) both the groups are same. This study clearly shows that there is something specific in the case of Jadugoda that causing health problem. If it is not the radiation then what else?

In this regard the stand of UCIL is not satisfactory. They are not lucid regarding the actual facts of radiation, their study and findings. They simply ignore the quest and health of tribal people. They are not conducting any meaningful study taking the people in confidence. Casual statements made by them are unable to ease the situation at all. The other astonishing fact that UCIL being the important agency of Central Government that talks about national security, has no security for the people of Jadugoda. There is total lack of security measure with regard to management of tailing disposed and transportation of ore from mines to mill.

Next, if we take for granted that there is no harmful radiation level to human being in reality, then also there are a lot of things the UCIL has to do for the betterment of the people in Jadugoda. This is because; the people are already in a frame of mind that uranium has caused ravage to their health. They feel psychological insecurity that is very much manifested in their social life. The UCIL must come up with a proper study and convincing result that can be transmitted to the common people in an acceptable way. They must take into account the local social workers and activists to communicate with people and make them scientifically aware about the actual cause of health problems and the real impact of radiation on their health and the safe way of dealing with this highly menacing particle.

In terms of rehabilitation it is seen that even after 30 years of operation UCIL has failed to rehabilitate the indigenous people. For the wellbeing of the people they must be removed from their present places and standard rules must be followed. If Uranium mine is related to national security the problems of Jadugoda tribal people

must be a national issue and national problem. This must be taken care of in full priority and delicately. They mustn't be left at the hands of few officials of UCIL as being the incognizant and illiterate tribal people—the so-called uncivilized one.

A detailed and extensive study on circumstantial evidence on occurrence of so called radiation related diseases in the area and also in other controlled area can through light in this regard. The study must be conducted taking simple variables and criteria excluding bombastic nuclear jargons so that people for whom the study is done can understand the end result. For obvious reason this study must be conducted by a neutral and independent organization.

KEY WORDS Radiation; linear no-threshold theory; tribal health.

ABSTRACT India's Uranium Mines and Uranium processing units have constantly been in conflict regarding radiation related health hazards on people of those areas. In recent years UCIL's (Uranium Corporation of India Limited) uranium mines and processing plants at Jadugoda have been a hot topic of discussion in print media as well as in electronic media owing to the so called radiation related health hazards among the people who are predominantly tribal. While the concerned authority and some scientific studies have been denying the effect of Low Level Radiation (LLR) on health, the local NGOs and activists have been claiming that the radiation related health effects are quite prominent in the area. The present article is an outcome of a brief field study conducted by the authors purely based on academic necessity. Nevertheless, it reveals an urgent need of an intensive and well planned study on the issue to ease the conflicting situation in Jadugoda.

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