A PROJECT REPORT

ON

UCIL COMPANY LIMITED IN SHILLONG

URANIUM CORPORATION OF INDIA LIMITED

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2014-2015

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ACKNOLEDGEMENT

First and foremost I offer my gratitude to Sir, F.D.Rynjah OSD UCIL Shillong and Sir, S.F.Kharlyngdoh for giving me the opportunity to do the project work on UCIL Company Limited in Shillong and alsoI would like to express my special thanks of gratitude to my teacher Sir, T.Tiewsoh as well as our principal Dr, K.D.Ramsiej who give me a golden opportunity to do this wonderful project on UCIL company limited in shilling, which also helped me in doing a lot of research and I came to know about so many new things I am really thankful to them.

Secondly, I would also like to thank my parents and friends who helped me a lot in this project within the limited time frame.

Dated: 4-12-2014

Place: Shillong

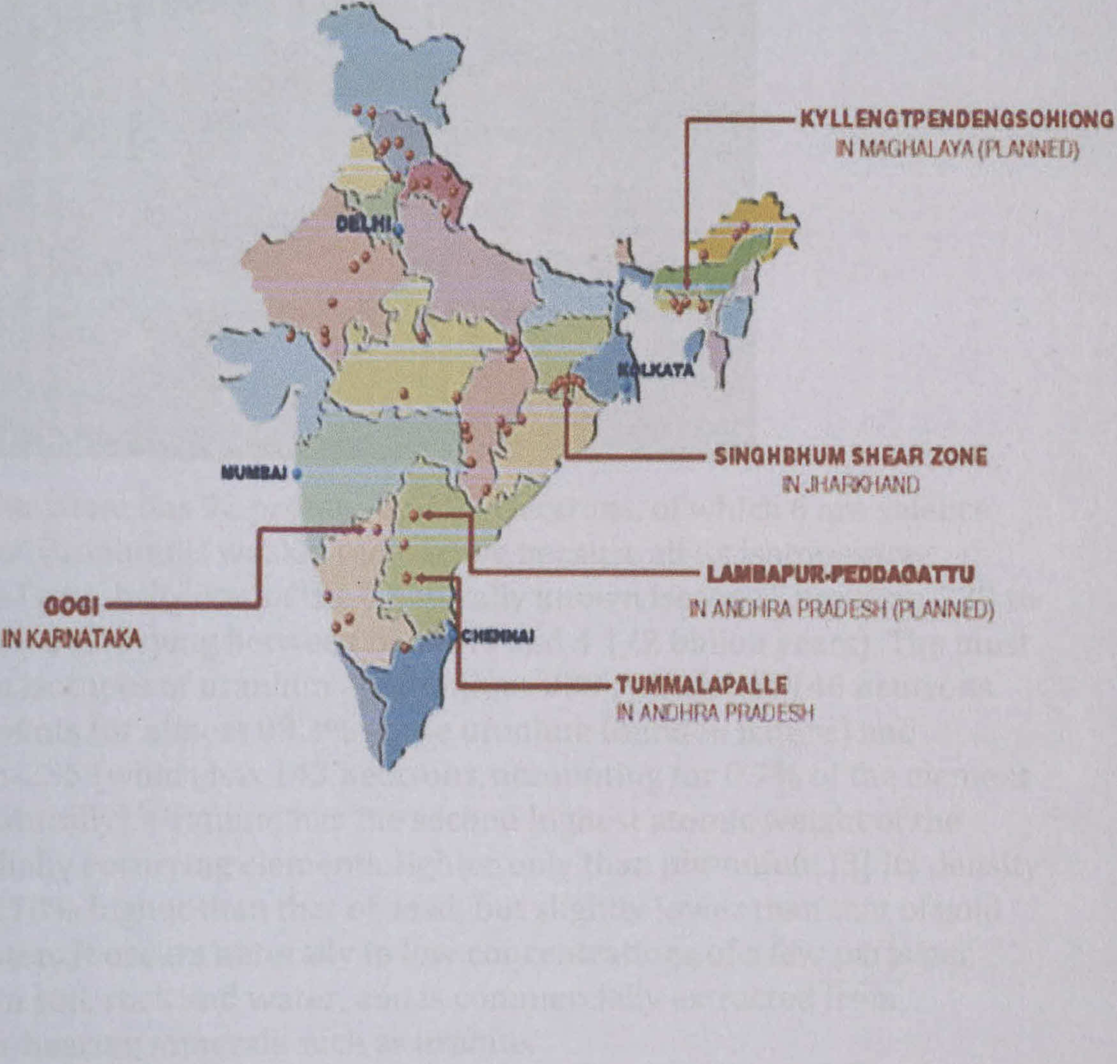
Kerborlang Kharlyngdoh

CHAPTER 1: INTRODUCTION

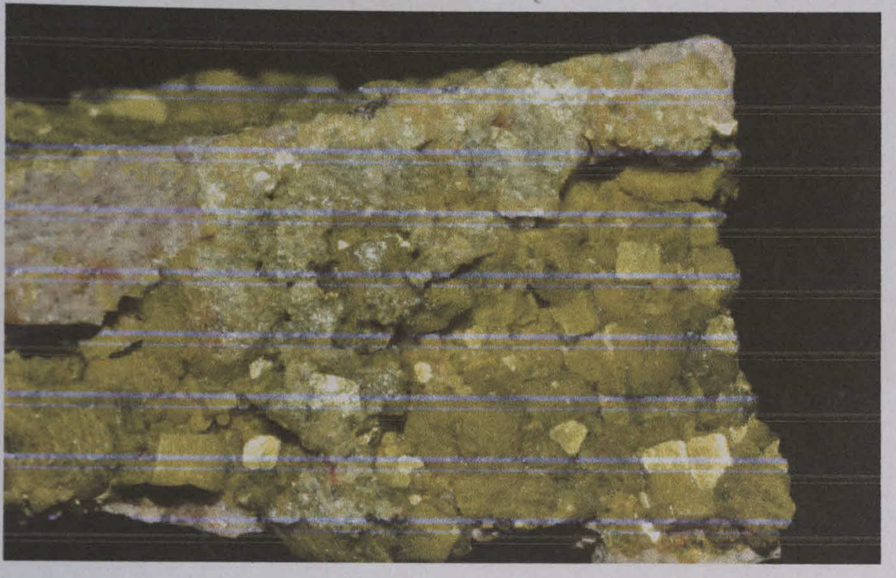
Uranium Corporation of India Limited (UCIL), a Public Sector Enterprise under the administrative control of the Department of Atomic Energy, was incorporated on 4th October 1967. UCIL is at the forefront of the Nuclear Power cycle, fulfilling the requirement of Uranium to fuel the Pressurised Heavy Water Reactors (PHWR). UCIL thus plays a very significant role in India's nuclear power generation programme. UCIL is an ISO 9001:2008, 14001:2004 & IS 18001:2007 certified company and has adopted state of the art technology in its mines and process plants.

Uranium ore, mined from different mines of UCIL is processed in its process plants and converted to Magnesium di Uranate and Uranium Peroxide respectively. This product is then transported to Nuclear Fuel Complex at Hyderabad where it is converted into Uranium fuel pellets and then to fuel bundles. These bundles are sent to various nuclear reactors located in different parts of the country for charging into the PHWR's as fuel, for generation of nuclear power.

UNITS OF UCIL IN INDIA



Uranium is a chemical element with symbol U and atomic number 92. It is a silvery-white metal in the actinide series of the periodic table.



A uranium atom has 92 protons and 92 electrons, of which 6 are valence electrons. Uranium is weakly radioactive because all its isotopesare unstable (with half-lives of the 6 naturally known isotopes, uranium-233 to uranium-238, varying between 69 years and 4 1/2 billion years). The most common isotopes of uranium are uranium-238 (which has 146 neutrons and accounts for almost 99.3% of the uranium found in nature) and uranium-235 (which has 143 neutrons, accounting for 0.7% of the element found naturally). Uranium has the second highest atomic weight of the primordially occurring elements, lighter only than plutonium.[3] Its density is about 70% higher than that of lead, but slightly lower than that of gold or tungsten. It occurs naturally in low concentrations of a few parts per million in soil, rock and water, and is commercially extracted from uranium-bearing minerals such as uranite.

Uranium, $_{92}U$

General properties	
Name, symbol	uranium, U
Pronunciation	/jʊˈreɪniəm/ *ew-**ray**-nee-əm*
Appearance	silvery grey metallic; corrodes to a spilling black oxide coat in air

PART TWO: OBJECTIVE

CHAPTER 1: OBJECTIVES

The objectives of UCIL are:

1. To mine and process uranium ore, produce concentrate and recover by-products at the most economic cost and markets them efficiently.

2.To achieve cost effectiveness through better capacity utilisation, quality improvement & optimum utilisation of human resources and maximise surplus generation through cost control and other measures.

3. To improve the quality of life and environment and attract the best talent available in the country through human resource development.

4. Augmentation of processing capacity.

5. Remediation of Tailing and waste dumps.

6. To maximise shareholder's value.

7. To emerge as a zero accident rate company.

8. To implement the on-going project within the cost and time frame as scheduled.

9. To evaluate new deposits for opening- up new mines and process plants.

10. To leverage domain knowledge in uranium mining and processing to acquire uranium assets overseas.

CHAPTER 1: MINE

A brief write-up of UCIL's minesare furnished below:

JHARKHAND, EAST SINGHBHUM DIST

- Jaduguda Mine

Jaduguda uranium mine, in operation since 1966 is presently the deepest operating underground metal mine in the country. With three stages of in-house shaft deepening, the mine pit bottom depth presently stands at 905m i.e. 3000 ft. below surface.

- Bhatin Mine

This is UCIL's smallest underground mine with limited production and is about 250m deep. Entry to the mine is through an audit and two inclines.

- Narwapahar mine

UCIL's 355m deep Narwapahar uranium mine is the most modern underground metal mine in the country with a dual entry system of a decline and a vertical shaft. The mine has been the precursor for modern mining technology in the country with usage of the latest trackless ergonomically designed equipment thereby enabling personnel & equipment carry out mining operations safely and without any fatigue.

- Turamdih Mine:
  Commissioned in 2003 Turamdih mine is UCIL's second mine to be designed along the lines of Narwapahar mine. The Mine uses similar modern underground mining technology and equipment.

- Banduhurang Opencast Mine:

UCIL's 3500 Banduhurang Mine commissioned in January 2009 has the distinction of being the first and only opencast uranium mine of the country. The uranium ore mined from this mine is processed at Turamdih Processing Plant located close by.

- Bagjata Underground Mine:

This mine commissioned in 2008 is located in a remote and extremist affected area. This mechanized mine has a decline entry with a shaft under construction and uses the latest underground mining equipment.

- Mohuldih Underground Mine

Mohuldih underground mine commissioned in March 2012 is UCIL's latest mine in Jharkhand. This modern mine feeds its ore to the Turamdih Process Plant for processing.

CHAPTER 2: PLANTS

There are two process plant of UCIL which are brief below:

1. Jaduguda Processing plant:

The uranium ores received from Jaduguda, Narwapahar, Bhatin&Bagjata Mines are all processed at Jaduguda Processing plant. Built alongwithJaduguda Mines in 1967, the processing capacity was augmented from 1000 TPD to 2090 TPD and finally to 2500 TPD in 2011. This plant has been consistently operating at optimum capacity utilization.

2. Turamdih Processing plant :

Turamdih mill commissioned in March 2009 with a capacity of 3000 TPD for processing the ore produced from Turamdih and Banduhurang open cast Mines is a significant milestone in the company's ambitious growth track towards fulfilling the country's uranium fuel needs. The plant operation utilizes some of the latest processing equipment as also the state of art control and monitoring facilities. The plant capacity has since been increased to 4500 TPD but is awaiting environmental clearance.

There are around five upcoming project of UCIL in India and that is

1. Expansion of Tummallapalle project, YSR District, Andhra Pradesh
    - Pre project activities are in progress to develop adjoining areas of Tummallapalle
2. Gogi Uranium project, Yadgiri District, Karnataka
    - Plan for one underground mine and processing plant
    - Pre-project activities are in progress with exploratory mining
3. Rohil Uranium Project, Sikar District, Rajasthan
    - Recently discovered
    - Plan for one underground mine and processing plant
    - Pre-project activities are being initiated along with plan for exploratory
4. Kylleng Pyndensohiong Mawthabah(KPM),West Khasi Hills District, Meghalaya
    - Near surface mineralization, amenable to open pit mining, more areas with promising exploration results
    - Pre-project activities are in progress
5. Lambapur-Peddagattu, Nalgondadistrict, Andhra Pradesh
    - Three underground mines and one open pit and a processing plant
    - Project activity on hold pending state government approvals and adverse public opinion

PART FOUR: CLASSIFICATION OF PRODUCT

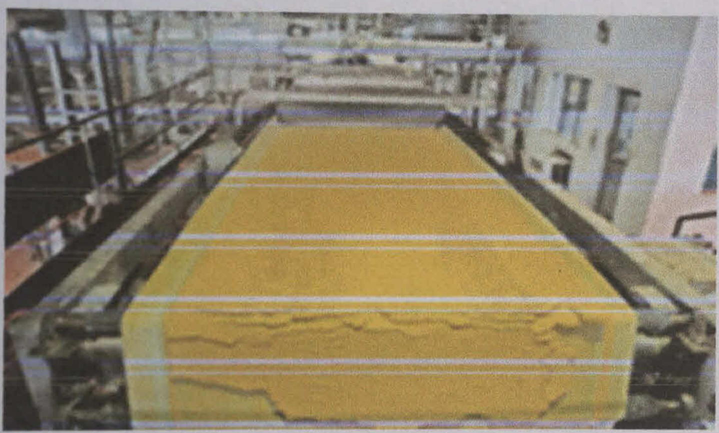
CHAPTER 1: MILL OUTPUT

Product are classify into

Mill output:-

1. For main product, Magnesium Di-Uranate (Mg U2O7), the customer is DAE who represent NFC, Hyderabad and for Pilot Plant, BARC Mumbai. The Magnetite is being produced as by-product.

For Magnetite Concentrate, coal washeries of M/s. TISCO, CCL & BCCL are the customers and product is sold to them by Purchase & Store Department with appropriate management approval.



2. For main product i.e. MDU (Magnesium Di-Uranate) the quality and

quantity is assessed on long term basis based on the mine ore production targets and their expected grade, leaching, recoveries etc. and the same is communicated to the customer DAE (NFC & BARC). An annual contract is signed accordingly with the customer.

4. For the magnetite concentrate, the quantity and quality are assessed based on targeted annual ore treatment and its grade. The annual contracts are signed between customers & UCIL.
3. The internal capabilities of the main product i.e. MDU is assessed based on the grade & production targets of Uranium Ore from different mines located at Jaduguda, Bhatin&Narwapahar of UCIL and their leaching characteristics prior to negotiation with the customers.

Grade & quality commitment based on the targeted production and actual production forms the basis for customer focus.

4. Mid-year review is made for the main product i.e. MDU and if any deviation from the main contract is observed, the same is documented and communicated to the customer.

CHAPTER 1: MINING OPERATION

All the mining operation are mechanized and cut and fill method of mining is followed. The basic flow sheet of mining operation is below.

Preparation of mine face-> Marking of ore boundary -> Drilling -> Blasting -> Mucking-> Hoisting ->transportation of ore to Processing plant

During the processes of mining, mine roof supporting activities is carried out prior and post mucking operation i.e. rock bolt grouting

For Mine ventilation properly designed fan has been installed at suitable location

Suitable pumping arrangement has been deployed for dewatering the mine.

For back filling of void generated in the mining operation mill tailing sand is used.

UCIL follows hydrometallurgical process for extraction of uranium from its ore. Out of three processing plant of UCIL, two process plant(at Turamdih and Jaduguda)follows acid leaching route and the third processing plant at Tummalapalle follows alkali leaching route. The basic flow sheet of hydrometallurgical process for extraction is below. The final product of Turamdih mill is Magnesium diuranate, Final product of Jaduguda id Uranium peroxide, Final product of Tummalapalle is Sodium Diuranate.

UCIL is presently operating in two states – Jharkhand and Andhra Pradesh.

It has seven operating mines (6 underground, 1 opencast) at Bagjata, Jaduguda, Bhatin, Narwapahar, Turamdih, Mohuldih , Banduhurang (open cast) and two Uranium Processing plants at Jaduguda and Turamdih respectively all located in the East Singhbhum district of Jharkhand. The man power strength of the organization is 4946 as on October 2014. As stated above UCIL is a public owned company with all its shares held by the Government of India. All its production goes as an internal sale transfer to Nuclear Fuel Complex which is a government organization under the Department of Atomic Energy.

CHAPTER 1: PURCHASING AND INVENTORY MANAGEMENT

The objective of purchase is to provide Stores and Equipment of 'specified' quality, in time an economical as well as fair, just & transparent manner.

Firstly how much of those items are available in the Stores.

Secondary how much is in the pipeline i.e., expected from suppliers against pending orders placed on them; and

Finally decide the actual quantity and type to be purchased after following all the purchase norms conforming to normally accepted procedures.

Maximum Stock level: Maximum is that quantity above which the stock of an item should not exceed the following points are to be kept in mind before fixing this level

a) Average rate of consumption.

b) Re-Order level and the delivery time to obtain supplies.

c) Economy in prices and order financial consideration.

d) Maintaining the quality of the material during storage.

e) Price fluctuation, if expected.

f) Risk of obsolescence and natural loss on storage.

g) Insurance costs, applicable to some materials.

h) Any restriction imposed by a regulatory government authority.

Minimum Stock Level: Is the quantity below, which the stock of an item should not be allowed to fall. The following points are to be kept in mind before fixing this level.

a) Re-ordering level .

b) Average rate of consumption of the materials.

c) Average time required to obtain delivery of fresh supplies.

Re-ordering level: Is the point between the maximum level and the minimum levels at which time it is essential to initiate purchase proceedings to procure fresh supplies of the materials. This point is usually slightly higher than the minimum stock level in order to cover situations arising from abnormal usage of materials or unexpected delay in receiving replenishment of fresh materials. Re-ordering level depends on factors like lead-time rate of consumption etc.

Emergent Purchases: Any materials which are to be obtained within a month from the date of issue of purchase Requisition shall be treated as an Emergency Purchase.

Proprietary Items: Are Items which are manufactured / made and / are owned by a particular manufacturer and marketed under a brand name.

Competent Authority: In any of the clauses of this Purchase Manual shall be C&MD except where otherwise specified under general/special orders.

Purchase Procedures

- The purchase function shall be centralized in the purchase department.

- Purchases other than emergent cash purchases must normally be from the approved suppliers.

- In order to encourage development of new vendors of specified items, depending on the nature and value of such items, advertisement should be inserted periodically in reputed national and local dailies inviting parties to offer themselves for enlistment as approved suppliers. Parties found suitable may be included in the suppliers list. Suppliers must give their email address.

Supplier's details required during the purchase process are:

1. A certified copy of their valid and latest income tax and sale tax Clarence certificate.
2. A list of reputed customers to whom or with whom they are also enlisted as accredited suppliers.
3. A detail statement showing the type of items that the party wants to supply.
4. If the party's registered in the small scale industries or a registered NSIC unit, a true copy of the registration certificate as applicable.
5. The list of approved suppliers will be kept updated. The head

purchase department will keep liaison with the concerned sector of the industries for identifying prospective suppliers of the various items required. The identifying department shall also be free to suggest new supplier to the head purchase.

6. The head purchase department will evaluate the performance of the various suppliers from time to time.
7. Once the suppliers has been enlisted his removal should be on good grounds and with due approval.
8. There must be more than source of supply for important materials except proprietary items.

Standard procedure followed in UCIL for purchase of consumable items:

Indentor raises purchase requisition. The requisition is submitted which further verified by the stores department then the same is sent to the central purchase department. Purchase department issue enquiry to the listed vendors on the basis of specification of item indented by the end user.

After receiving offer from the supplier comparative statement is prepared by the purchase department and sent to the indenter for recommendation. After receiving positive recommendation for the respective party, purchase order is issued to the recommend vendor.

After receiving of the material at the receive section of stores, material is inspected by the end user. Getting a positive inspecting feedback material is issued for further use in the concerned department or production line.

PART SEVEN: VISION AND FUTURE EXPANSION

CHAPTER 1: VISION

The Vision of UCIL is to constantly strive to develop and implement a technology suitable for mining and processing of Uranium Ore at a competitive cost and to diversify towards mining, Tunnelling and process related consultancy and other project implementation ventures.

This expansion is the upcoming project of UCIL that are already discuss in part three chapter one.

1. Expansion of Tummallapalle project, YSR District, Andhra Pradesh

- Pre project activities are in progress to develop adjoining areas of Tummallapalle

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- Plan for one underground mine and processing plant
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3. Rohil Uranium Project, Sikar District, Rajasthan

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CHAPTER 1: MEANING

In physics, radiation is a process in which electromagnetic waves (EMR) travel through a vacuum or through matter-containing media; the existence of a medium to propagate the waves is not required. A different but related definition says radiation is a subset of these electromagnetic waves combined with a class of energetic subatomic particles with very high kinetic energies; these are called ionizing radiation, and the particles are termed particle radiation.

Some of the uses of radiation are as follows:

1. Medical uses:Hospitals, doctors, and dentists use a variety of nuclear materials and procedures to diagnose, monitor, and treat a wide assortment of metabolic processes and medical conditions in humans. In fact, diagnostic x-rays or radiation therapy have been administered to about 7 out of every 10 Americans. As a result, medical procedures using radiation have saved thousands of lives through the detection and treatment of conditions ranging from hyperthyroidism to bone cancer.

   The most common of these medical procedures involve the use of x-rays — a type of radiation that can pass through our skin. When x-rayed, our bones and other structures cast shadows because they are denser than our skin, and those shadows can be detected on photographic film. The effect is similar to placing a pencil behind a piece of paper and holding the pencil and paper in front of a light. The shadow of the pencil is revealed because most light has enough energy to pass through the paper, but the denser pencil stops all the light. The difference is that x-rays are invisible, so we need photographic film to "see" them for us. This allows doctors and dentists to spot broken bones and dental problems.

X-rays and other forms of radiation also have a variety of therapeutic uses. When used in this way, they are most often intended to kill cancerous tissue, reduce the size of a tumor, or reduce pain. For example, radioactive iodine (specifically iodine-131) is frequently used to treat thyroid cancer, a disease that strikes about 11,000 Americans every year.

X-ray machines have also been connected to computers in machines called computerized axial tomography (CAT) or computed tomography (CT) scanners. These instruments provide doctors with colour images that show the shapes and details of internal organs. This helps physicians locate and identify tumours, size anomalies, or other physiological or functional organ problems.

In addition, hospitals and radiology centre's perform approximately 10 million nuclear medicine procedures in the United States each year. In such procedures, doctors administer slightly radioactive substances to patients, which are attracted to certain internal organs such as the pancreas, kidney, thyroid, liver, or brain, to diagnose clinical conditions.

2. Academic and Scientific Applications:
   Universities, colleges, high schools, and other academic and scientific institutions use nuclear materials in course work, laboratory demonstrations, experimental research, and a variety of health physics applications. For example, just as doctors can label substances inside people's bodies, scientists can label substances that pass through plants, animals, or our world. This allows researchers to study such things as the paths that different types of air and water pollution take through the environment. Similarly, radiation has helped us learn more about the types of soil that different plants need to grow, the sizes of newly discovered oil fields, and the tracks of ocean currents. In addition, researchers use low-energy radioactive sources in gas chromatography to identify the components of petroleum products, smog and cigarette smoke, and even complex proteins and enzymes used in medical research.

Archaeologists also use radioactive substances to determine the ages of fossils and other objects through a process called carbon dating. For example, in the upper levels of our atmosphere, cosmic rays strike nitrogen atoms and form a naturally radioactive isotope called carbon-14. Carbon is found in all living things, and a small percentage of this is carbon-14. When a plant or animal dies, it no longer takes in new carbon and the carbon-14 that it accumulated throughout its life begins the process of radioactive decay. As a result, after a few years, an old object has a lower percent of radioactivity than a newer object. By measuring this difference, archaeologists are able to determine the objects approximate age.

(i)Electricity generation

The demand for energy increases with the world's booming population and expanding economy. We are consuming energy at a pace much faster than it can be replenished. Nuclear energy is one of the solutions to meet this ever increasing demand of energy. To date, there are about 440 commercial nuclear power reactors around the world, mainly relying on splitting, or fissioning, of uranium or plutonium nuclei. These reactors generate about 17% of the electricity world-wide.

Guangdong Nuclear Power Station and Lingao Nuclear Power Station at Daya Bay are located some 50 km to the northeast of Hong Kong. They began commercial operation in February 1994 and May 2002 respectively. Both stations use pressurized water reactors to generate power for the people of Hong Kong and Guangdong. Please click here for information on the design and operation of the nuclear power stations.

(ii) Medical applications:

Many of us are aware of the widespread use of radiation in the medical community. It can be used for diagnosis as well as therapy for a number of diseases.

In diagnostic treatments, x-rays can provide images for identifying abnormal changes in body organs and tissues. With advanced imaging and computing technologies, a three dimensional picture or animation can be generated to facilitate the diagnostic treatment if radioisotopes are injected or ingested into the patient. The most widely used diagnostic radioisotope is technetium-99m which has a half-life of six hours and releases ■ rays during radioactive decay. While giving the patient a very low radiation dose, technetium-99m allows sufficient time for the diagnosis process.

In therapy treatments, a radioisotope of iodine, iodine-131, is used to treat thyroid cancer. For some cancers, ■ rays from cobalt-60 sources are used to destroy cancer cells. Irradiating a tumour with ionizing radiation has proved to be effective in inhibiting the tumour's growth or even destroying it.

Nowadays, many medical utensils are sterilized by ■ rays from cobalt-60 sources. This technique is much cheaper and more effective than steam sterilization. Disposable syringe, cotton wool and surgical consumable are good examples. Since it is not a high temperature treatment process, it can be used to sterilize a range of heat-sensitive items such as plastics. In addition, as ■ rays have very high penetrating power, the sterilization process can be done after the item is packaged. This ensures that the item is free from bacteria before being used.

Since the discovery of anthrax-laden mail in US in October 2001, US Government uses x-rays in the same manner as in medical usage to sterilize suspected items sent through mail to avoid panic in the country.

(iii)Industrial and agricultural applications:

Rays with high penetrating power are used to image defects in welds and metal castings. In addition, radiation is widely used in automatic quality control systems in production lines, such as to gauge fluid level in beverage cans or density of tobacco in cigarettes. It is also used to measure the thickness of electroplates and to eliminate static charges in industries.

In agricultural applications, radioisotopes are usually used as tracers. Fertilizers doped with radioisotopes provide a means to find out the amount of fertilizer up taken by crops and the portion that is lost. In addition, radiation can be used to exterminate insects. Sterile Insect Technique (SIT) is applied to inhibit the reproducing power of the insects so as to reduce their population. The SIT operations conducted in Mexico were successful in reducing the number of pest/insects significantly. With the support of the United Nations Food and Agriculture Organisation (FAO) and the International Atomic Energy Agency (IAEA), the SIT programmes are underway in a number of countries

(iv)Archaeological applications:

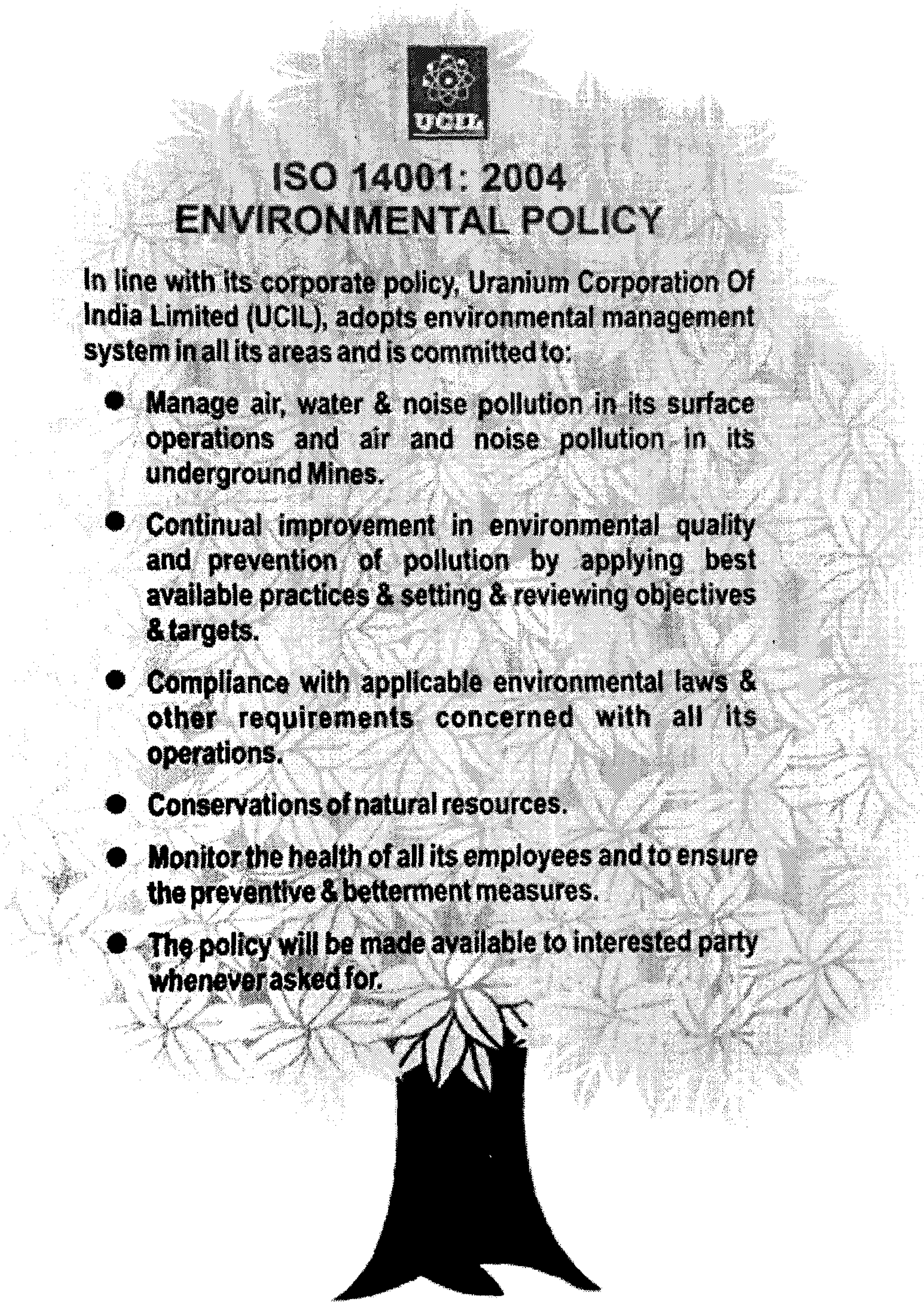
Antiquities can be dated by measuring their natural radioactivity. Popular techniques include "carbon-14 dating" and "thermoluminescence dating". They are useful tools in geological, anthropological and archaeological researches.

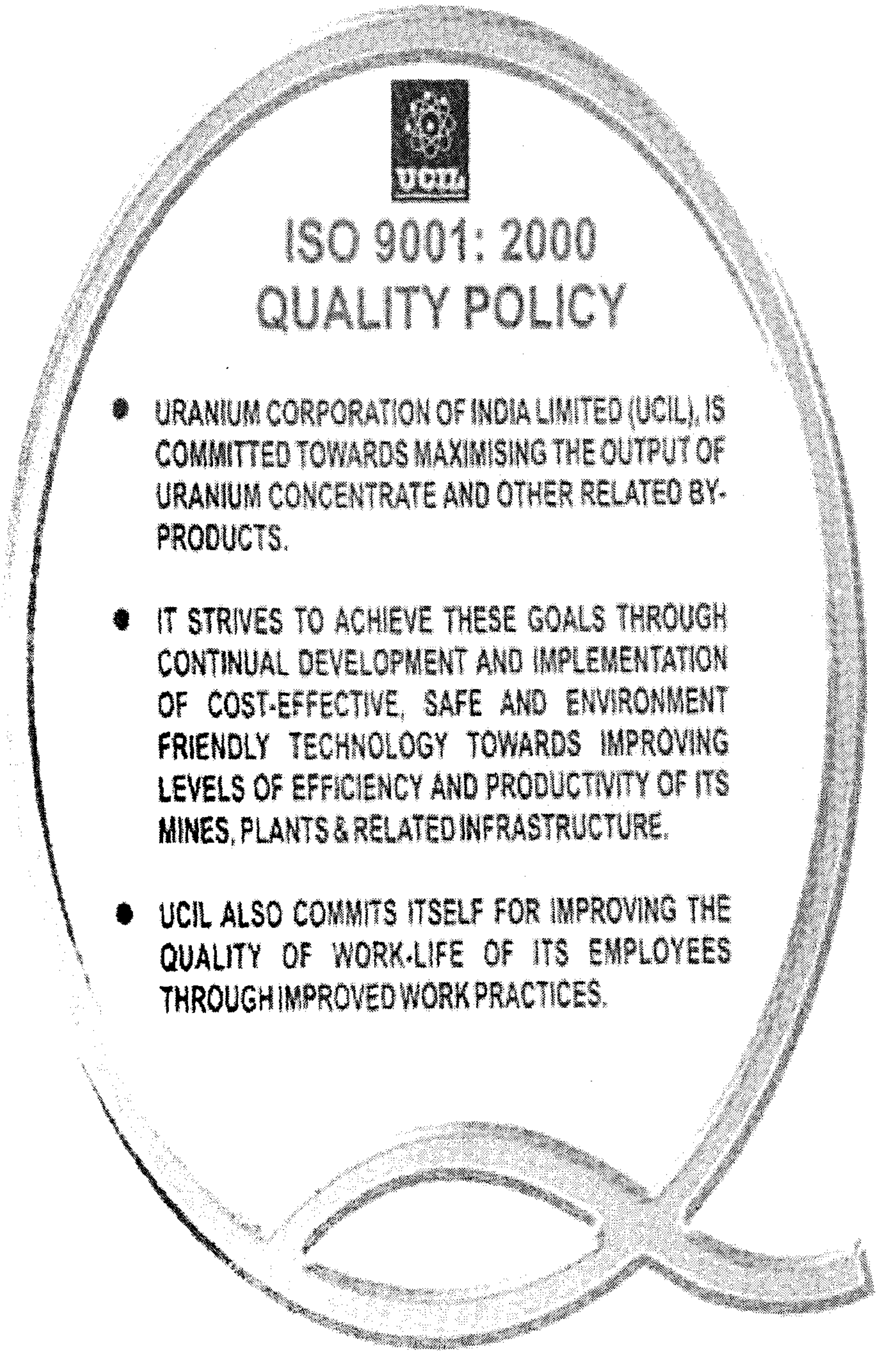
Carbon-14 is produced when cosmic rays bombard the atmosphere. The carbon-14 formed will be oxidized to carbon dioxide and absorbed by plants. Meanwhile, animals will ingest plants and hence most of the organic materials contain a certain amount of carbon-14. As soon as the plants or animals die, the uptake of carbon-14 will cease and the amount of carbon-14 will decrease with time due to radioactive decay. The half-life of carbon-14 is about 5,730 years. By measuring the amount of carbon-14 in the ancient organic materials, we can estimate the time when the organism died.

Trace amounts of natural radioactive materials, such as uranium, thorium and potassium with half-lives of up to one billion years, exist in soil. When the inorganic crystal in clay is irradiated by the

above radioactive materials, part of the radiation will be released in the form of light and the rest will be trapped in the crystal.
When such crystal is heated, the stored energy will be released as light, the so called thermoluminescence effect.
Thermoluminescence dating can be used to determine how much time has elapsed since the last time the object was heated. The older the object, the more light will be released.
Thermoluminescence dating is commonly used to determine the age of pottery.

CHAPTER 1: ENVIRONMENTAL POLICY




UCIL
ISO 9001: 2000
QUALITY POLICY
URANIUM CORPORATION OF INDIA LIMITED (UCIL), IS COMMITTED TOWARDS MAXIMISING THE OUTPUT OF URANIUM CONCENTRATE AND OTHER RELATED BY-PRODUCTS.
IT STRIVES TO ACHIEVE THESE GOALS THROUGH CONTINUAL DEVELOPMENT AND IMPLEMENTATION OF COST-EFFECTIVE, SAFE AND ENVIRONMENT FRIENDLY TECHNOLOGY TOWARDS IMPROVING LEVELS OF EFFICIENCY AND PRODUCTIVITY OF ITS MINES, PLANTS & RELATED INFRASTRUCTURE.
UCIL ALSO COMMITS ITSELF FOR IMPROVING THE QUALITY OF WORK-LIFE OF ITS EMPLOYEES THROUGH IMPROVED WORK PRACTICES.

IS 18001: 2000
OCCUPATIONAL HEALTH & SAFETY POLICY

Uranium Corporation Of India Limited (UCIL), adopts OHSMS as an integral part of its business performance and is committed to maintain high level of Occupational Health & Safety (OH&S) at the work places and control radiation & mining/ processing related hazards. The company is further committed to:

- Design, Construct, operate and maintain its facilities to ensure safety of employees, plant & equipment.
- Comply with all relevant statutory rules and regulations on OH&S.
- Impart training and re-training of all employees including contractor workers with the emphasis on development of safety-oriented skills.
- Provide adequate resources to implement OH&S policy.
- Continually improve the OH&S performance by setting and reviewing of OH&S Objectives and targets.
- Ensure good health of all the employees through regular medical check up.
- Ensure communication, understanding and maintenance of the policy at all the levels.

Development programme:

Company continued its efforts towards peripheral development of its surrounding villages. The vocational training programme to local unemployed youths in collaboration with Jan Sikhshan Sanstha (an organization under the Ministry of Human Resource Development) is being conducted regularly. They were imparted training on different trades like mushroom cultivation, health care, training in cottage industries like making of candle, incense stick, greetings card, sericulture, chalk making and tailoring etc. One mushroom drier has been donated to villagers so that their products are well preserved for better market prospect.

Company organizes free medical camps periodically and distributes free medicines to the surrounding villagers. With a view to provide free medical services to the local population, Company has set up a Rural Medical Centre at Narwapahar.

The Talent Nurture Programme (TNP) of the company imparts free education to the children of the economically backward people of the surrounding villages. Under this programme, every year about 30 children are being selected from the tribal community of the surrounding villages for admission to Atomic Energy Central Schools run by the company. Apart from free education, these students are provided with complete set of text books, exercise books and uniforms at free of cost and also a monthly stipend of Rs.300/- for male child and Rs.400/- for every child.

Besides above, company also organizes various sports activities for employees as well as local youths at regular intervals under the aegis of the Jaduguda Sports Council. Family welfare programme and blood donation camp are also organized from time to time. Health camps are also being organized at regular basis for local villagers.

UCIL follows approved Rehabilitation & Resettlement Policy in letter and spirit. More than one thousand land displaced persons in various projects have been provided employment.
UCIL has started Industrial Training Centre to equip local youths with skills required in Industries. Classes for first batch of 20 students have started from academic year 2008-09.

In the last three decades, consumption of electricity has been increasing in India at the rate of around 10% per annum. Starting with a meager 2300 MW in 1950, the installed capacity by March 2001 has risen to around 102 GW. Of this 25% is met by hydro, 72% by thermal power, based on coal and about 3 % by nuclear energy. India is a country occupying 2% of the world's landmass and currently generating about 3% of the global electricity. However India has a share of 16% in the world's population. To achieve a moderately high level of economic growth, the domestic electricity generation capacity needs to be increased manifold.

Through coal reserves in India are estimated to be nearly 13,000 crore tonnes, most of them are confined to a limited region in eastern and Central India. Nearly 35% of the country by area and 30% by population are more than 800 km away from coalfields. Hence, there are practical limits in transporting coal to thermal power stations located in the Western, Southern and Northern parts of India (apart from limitations on production). The total hydroelectric potential that can be economically exploited has been estimated to be about 41000 MW. Of this 25400 MW capacity is under operation. The non-conventional energy resources like solar, wind and tidal are all diffused sources of energy suitable for decentralized application. However, these sources are unlikely to meet more than a small fraction of our energy needs for many years.

Nuclear power is one source, if given impetus, can generate electricity at costs competitive with coal-fired power stations in certain location. A tonne of uranium fed into the nuclear power station produces as much heat as about 25,000 tonnes of coal taken over the life times of the stations, the low fuelling cost of nuclear stations out weights the higher cost of building them.

One important advantage of nuclear power is that it avoids a wide variety of environmental problems arising from burning fossil fuels like coal, oil and gas. The problems that have received the most publicity have been 'global warming', which is changing the earth's climate, acid rain, which is destroying forests and killing fish; air pollution, which is killing tens of thousands of people every year; the destructive effects of massive mining for coal and oil spills which do great harm to ecological systems.

NUCLEAR WASTE MANAGEMENT:

Nuclear power, like all industries, gives rise to wastes. Because they are in general radioactive, they are subject to strict control. In India, the basic philosophy of radioactive waste management has been to concentrate and contain as much radioactivity as possible and discharge effuents to the environment effluents at as low a concentration level as practicable. Facilities are provided at the Nuclear installations for safe disposal of radioactive waste. Solid wastes are stored at site and release of liquid and gaseous effluents are so organised that the prescribed dose limits for public are strictly adhered to

The various waste management schemes adopted are:

- All the gaseous effluents are rounded to the atmosphere through highly efficient particulate air filters for removal of particulate radioactivity. These are monitored to ensure that releases are within stipulated limits.
- Liquid waste facility provides chemical treatment followed by ion exchange treatment. The wastes are then diluted to achieve the final stipulated discharge concentration limit as necessary.
- For low level liquid water, after checking, sold for by product recovery.
- For low level solid wastes, no direct disposal into the ground is practiced. Wastes are incinerated or baled and stored. Different types of containments are used and located at sites selected on the basis of geological and geohydrological evolution. This is followed up by continuous monitoring of ground water, soil and elaborates environmental surveillance through special laboratories set up near installations.
- For long lived, highly active solid wastes generated from at various plants, a three - stage approach has been adopted. Firstly, the waste be incorporated in suitable and inert solid matrices. The conditioned waste will then be placed in canisters and kept in a retrievable store under cooling and constant surveillance. Ultimately, canisters will be stored in suitable geological media. India is one of these countries who have mastered the verification technology for converting radioactive waste into glass.