GIDC DEGREE ENGINEERING COLLEGE, ABRAMA.

A REPORT ABOUT A NATIONAL SEMINAR HOSTED BY SAFFRONY INSTITUTE OF TECHNOLOGY, MEHSANA ON 15TH -16TH, FEBRUARY, 2019.

INTRODUCTION

The seminar was about the "Applications of Radioisotopes and Radiation Technology in Agriculture, Healthcare & Industries"

This report shows the chronological series of events as they unfolded on Feb 15th & 16th, 2019, and what we learnt as a team sponsored by GIDC Degree Engineering College, Abrama.

We left Navsari on 15th Feb, 2019 at 4:00am and arrived at Saffrony Institute of Technology Mehsana at 9:45 am. We were registered and proceeded to the auditorium.

INAUGRAL SESSION

We attended an inaugural session graced by senior professionals and citizens who included;

- Anil K. Anand (President NAARRI),
- Shri Priyesh Dalal (Managing Trustee, Saffrony Institute),
- Mr. J. Chandhi (Secretary NAARRI),
- Shri Kantibhai patel (Director cooperative bank at state and National Level),
- Shri Sudhirbhai Dhavel (BOG Member & Convener).

Shri Priyesh Dalal gave an official welcoming speech. He thanked all the eminent scientists &researchers for their presence and further thanked all the faculty & student representatives from fifty five (55) colleges all over Gujrat, for their attendance.

Mr. J. Chandhi (Secretary NAARRI) was the next speaker. He told us that NAARRI (National Association for Application of Radioisotopes & Radiation in Industry) was formed in 1976, for creating awareness about the peaceful Applications of radioisotopes & radiations in industry by organizing seminars in India. He also told us that NAARRI has organized an exbhition from the department of Atomic Energy (DAE) which will depict all the advancements made by the experts in this field.

Mr. Anil K. Anand (President NAARRI), was the next speaker. He said that applications of Radioisotopes in Health, industries employ more people than those who work with Atomic energy to produce electricity. He also told us that India is considered as a developed country (6th most advanced country) in Atomic energy.

The next event was the unveiling of the Souvenir by the dignitaries on the Dais.

Shri Sudhirbhai Dhavel recognized the contribution of **Shri Jagnesh Patel**, who was the first person in Gujrat to recognize the potential of Radiation Technology, despite coming from a commerce background. He deals with Gamma irradiation units.

Shri Sudhirbhai Dhavel also gave a vote of thanks to the dignitaries on the dais, the eminent scientists, faculties and students, as the inaugural session came to an end.

TECHNICAL SESSION.

1. **Shri G. Ganesh, Chief Executive, BRIT (Board of Radiation & Isotope Technology)** which is a unit of DAE.

Topic: General overview of Radioisotope and Radiation technology program in India especially in non-power applications & DAE.

He defined radioisotopes, half-life, and explained factors to be considered in selection of a particular radioisotope for a particular application.

These factors include;

- Application.
- Penetrating power
- Half-life.
- Effect of the radiation.

>**Application of Radiations in health care;**

- Diagnostic (requires short half-life like Gamma particles)
- Therapeutic (requires long half-life like Beta particles)
- Blood irradiation.

>**Application of Radiations in Agriculture;**

- Food hygiene
- Genetic improvements of plants
- Insects, pests & diseases management
- Studies of soil-plant relationships
- Food processing
  - Low dose applications.
  - Medium dose applications.
  - High dose applications.

>**Applications of Radiations in Industry**;

Sealed source

- Gamma scanning.
- Radiography testing (NDT)

- Industrial tomography
- Nucleonic control systems

Open source

Radio tracers.

2. **Dr. S. Gautam (Head FS & SS) at BARC (Bhabha Atomic Research Institute)**

Topic: Radiation Processing.

He defined food irradiation as a process where food is exposed to certain amount of energy to achieve certain objectives.

He explained the need of food irradiation in India, which is basically to;

- Improve food security,
- Ensure food safety like sprouting of potatoes, onions etc.
- Reduce agricultural product losses, currently standing at Rs.92000 crores.
- Supporting international agricultural trade by ensuring globally accepted pest free products like mangoes.

3. **Dr. S F D'Souza. (Former Associate Director, BMG & Head, NABTD,BARC, Mumbai)**

Topic: Radiation Technology and mainly, Improvement of Crops.

He told us that Major emphasis is on oil seeds and pulses which include;

- Groundnuts
- Mustard
- Sunflower
- Linseed
- Soybean
- Pigeon pea
- Mung
- Cowpea
- Rice
- Wheat

He said that their first priority is Productivity and then they will focus on disease resistant crops.

Their **approach towards improvement of crops** is;

- Introduction
- Selection.
- Cross breeding

- Mutation breeding
- DNA Recombinant Technology.

4. **Dr. Lalit Varshney (Former Head, RTDD, BARC)**

Topic: Dry sludge hygienization using Radiation.

He told us that, averagely, every individual produces about 18-20kgs of waste every day, which means that India produces a lot of waste since it has a high population.

He said that their aim is to manage waste at an early stage.

He told us smaller organisms (like viruses) require less doses of radiations to be deactivated, compared to large organisms.

Indian cities produce over 40 Billion liters of sludge.

Sludge is rich in macro nutrients, organic carbon and pathogens. So, when, sludge is exposed to radiations in sewerage plants, pathogens are killed or reduced to very low levels. This makes sludge material a very good bio fertilizer.

He concluded with an amazing quote by Marie Curie, which says “Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less”

5. **Dr. Avinash U. Sonawane, Head, DAR&C, AERB, Mumbai.**

Topic: Radiology safety and Regulations in applications of radiation sources.

He told us that the mission of Atomic Energy Regulatory Board (AERB) is to ensure that the use of Radiation sources does not cause undue risks to the people of India.

He told us that before anyone purchases any radiological equipment or facility in India, they must first get a license from AERB.

Before AERB issues a license, they study the potential hazards related to the application, and estimate the level of risk. Then, they recommend the safety measures to be followed by the buyer, and then they keep monitoring.

However, the major condition of issuing a license for any radiation source, is that, it must be beneficial to the society and must present the minimum acceptable risk to the society.

As a result of their keen licensing regulations, the Indian Nuclear reactor has broken a world record of running for 943 days (as on 14th Feb 2019) without any accident. The previous safety record was 922 days.

Also, transportation of a radioactive source by a supplier, requires a transportation license from AERB.

Due to the safety regulations and guidelines, India has not registered any major radiation accidents since independence.

6. **Shri V. K. Sharma, IRAD, BARC, Mumbai.**

Topic: Applications of radiotracers and sealed sources in industries for troubleshooting and process optimization.

He told us if students want to join BARC, they can join by GATE score or direct examination with BARC. He also told us that, Girls do not need to pay any examination fees to join BARC.

He told us that, they have a lot of Nuclear reactors, and the first reactor was constructed in 1956.

Some of the **applications of radiotracers** include;

- Radiometry for inspection Like in thickness measurements.
- Weld beads
- Radiography testing (NDT) and scanning.

He told us about the number of drainage experiments at Kolkata ports which have saved a lot of money.

7. **Dr. S. Chaturvedi, Director, IPR, Ahmedabad.**

Topic: Plasma Technologies for Societal Applications.

He defined Plasma is the fourth state of matter.

Applications of Plasma.

- Mining & construction Industry
- Aerospace Industry
- Automobiles industry
- Defense
- Hydropower industry
- Biomedical industry
- Environment
- Textile industry
- Metallurgy

He told us about some of the **technologies which they have developed**. They include;

- Plasma pyrolysis and energy recovery
- Plasma nitrating and nitro carburizing
- Plasma coatings
- Plasma sealed coatings
- Plasma arching and surface activation of different things.
- Plasma processing applied to textiles.
- Pencil torch
- Synthesis of Nano powders & Nano patterns

Plasma Pyrolysis unlike incinerators, either decomposes wastes, which can be used as fertilizers or get energy from syngas, depending on the type of waste you are dealing with.

2nd day of the seminar (16th Feb, 2019).

8. **Dr. S. K. Shrivastava, (Director, Radiation Oncology, Apollo Hospitals, Navi Mumbai)**

Topic: Application of Radiation Technology in Healthcare: Cancer treatment.

Statistics show that while cancer is increasing all over the world, the rate of increase is higher in Asia. Therefore, we need to understand more of cancer, and know how to deal with it.

He briefly talked about the human body anatomy, where;

A Cell is made of Nucleus, chromosomes.
Therefore, the major component of our bodies is a cell. We therefore need to protect cells, yet Cancer affects the cells, in different organs.

Types of Tissues.

Based on structure and Function;

- Epithelial tissues
- Connective tissues
- Muscle tissues
- Nervous tissues.

WHO (World Health Organization) recommended Steps in fighting cancer;

- Prevention, Screening & Early detection.
- Treatment.
- Palliation.

Seven warning signs of cancer.

- Change in bowel or bladder habits
- A sore throat that does not heal
- Unusual bleeding or discharge from body orifice
- Thickening or lump in breast or elsewhere
- Indigestion or difficulty in swallowing
- Obvious change in wart or mole
- Nagging cough or hoarseness.

Major Treatments of Cancer.

- Surgery
- Radiotherapy
- Chemotherapy (primary treatment for blood cancer)
- Hormones
- Biological therapy
- Combined modality.

Cancer is a spectrum of diseases therefore, it usually requires a combination of treatments.

Therefore, treatment of cancer is a teamwork among doctors from different specializations.

He explained basic principle of radiotherapy which is, basically, exposing infected cells to a suitable dose of radiations and less or no radiations to non-infected cells.

9. **Dr. Shamila Banerjee, Head, RMC, Mumbai & Adjunct Dy.C.E, BRIT, Mumbai.**

Topic: Applications of Radioisotopes and Radiation in Human Healthcare.

Areas of Applications in Medical field include;

- Diagnostic
- Therapeutic
- Sterilization.

She quoted the words of Homi Bhabha's vision about Radiosotopes in medicine, "We are interested in promoting the use of isotopes in medicine, for research, clinical investigation and therapy and in assisting the advance of medicine generally by providing this additional tool for both long range and short range medical research"

She said that Homi Bhabha's vision still inspires them to do as much research as they can in using Radioisotopes in medicine.

She talked about Radiopharmaceutical and defined it as, a special class of radiochemical formulations having high purity and safety for human administration and used for either diagnosis or therapy in cancer.

She said that they get radioisotopes from Nuclear reactors or can also be generated from a radioisotope generator system.

Types of radiopharmaceuticals;

- **Diagnostic.**

Radiolabeled molecules designed to produce images of the specific disease site.

- **Therapeutic.**

Radiolabeled molecules designed to deliver therapeutic dose of ionizing radiation to specify disease site.

- **Theranostic**.

Radiolabeled molecules having matched pair of radioisotopes (diagnostic & therapeutic) for both applications.

In Diagnostic radiopharmaceuticals, they use two main imaging techniques, namely;

SPEC

PET (This gives a better image)

Radio iodine therapy is used for treatment of Thyroid cancer, which is the most common type of cancer treated at RMC.

She concluded her presentation with a take home message clearing a myth with a fact.

Myth: Radiations cause cancer.

Fact: Radiations are used to treat cancer.

10. Shri K. S. S. Sarma, Former head, IRAD, BARC, Mumbai.

Topic: Electron Beam Technology for industrial Applications.

Electron beam processing for material modification.

Irradiation (or exposure) of industrial products to high energy electrons, on industrial scale, with accepted dose uniformity to induce desired physical / chemical / biological changes.

Popular EB processing Applications.

Established Applications.

- Polymerization
- Polymer Crosslinking & Degradation
- Crystalline alterations
- Food irradiation.

Potential applications.

- Flue gas treatment.
- Waste water treatment
- Sewage sludge treatment.

He said that, High energy electrons are produced in accelerators and are then safely utilized for various industrial applications.

These Electron accelerators are “on & off” machines.

He defined an accelerator as a device that uses electromagnetic fields to propel charged particles to high speeds and to contain them in well-defined beams.

Three Categories in industrial EB accelerators

- Low energy (200keV to 700keV)
- Medium energy (700keV to 5000keV)
- High Energy (5MeV to 10MeV)

Products for EB processing include;

- Surface curing.
- Crosslinked wire & cable insulations
- Heat shrinkable materials
- PE foam materials
- PTFE Degradation
- Radiation Sterilization &food items.

Main Parameters in EB are;

- Beam energy (decides the process thickness)
- Beam current (dose rate……throughput)

11. Dr. A. K. Kohli, Former RRF, BARC, Mumbai.

Topic: Impact of Security Issues on Radiation Facilities.

He started his presentation with a hearty sad moment about the Pulwana attack on 14th Feb 2019, and consequently explained the impact of security on our radiation facilities.

He talked about measures to ensure no radiological risks;

- Design safety features.
- Operational Safety features.

He talked about some radiation related accidents;

- Costa Rica Radiotherapy Accident, 1996,

It was as a result of poor calibration.

That caused patients who received treatment to get 50% more than their actual dose.

- Goiania, Brazil-1987.

A radiotherapy machine with a cesium source was abandoned but later stolen and was sold as scrap.

It got mixed with water and 249 people were significantly affected and 4 people died.

He compared accidents related to safety of radiations and other fields, and the statistics were in favor of radiation (nuclear) facilities.

He then singled out a terror attack (11th Sept 2001) on Twin towers, USA by Osama Bin Laden who said “Acquisition of Nuclear weapons & weapons of mass destruction is a religious duty”.

Therefore, it can be seen that apart from safety, Security is very important in preventing malicious use of Radioisotopes.

Likely consequences of the malicious use of sources include;

- Death
- Contamination
- Evacuation
- Loss of function (area of facility)
- Fear and social disruption
- Psychological effects
- Economic disruption.

It is a cruel paradox that radioisotopes which can be used to carryout large number of diagnostic investigations and therapeutic treatments, on their abuse, can also injure and take large number of human lives.

After the September 11th terror attack, a lot of safety and security meetings took place, and a number of laws & regulations were enacted in different countries, including India.

Measures to prevent unauthorized acts;

Deter-Detect-Delay.

- Security by design
- Physical protection measures
- Administrative measures
- Trained security personnel
- Nuclear security culture.

He concluded his presentation by telling us that, "Security is 20% equipment and 80% culture"

12. Dr. D. K. Sahoo. (Senior Manager BRIT).

Topic: Laboratory Research Irradiators with Enhanced Security features.

He defined Laboratory Research Irradiators (Gamma chamber) as;

an equipment which contains sealed radiation source, and delivers controlled radiations to obtain a desired result.

Applications of Laboratory Research Irradiator include;

- Medicine & healthcare
- Industry
- Agriculture
- Research.

Research Applications include;

- Space applications
- Study the effect of radiation on material
- Optimizing dose requirement for specific purpose
- Electron applications
- Dosimetry studies and development.

He told us that their **scope** is;

- Generic approval: Class specific, wide domain for dose.

- New applications.
- Services to other institutions.

Components of a Laboratory Research Irradiator are;

- Radiation source like Cobalt-60
- Sample Chamber (product volume for irradiator)
- Biological shielding for safety
- Mechanism of product movement in and out of radiation field
- Interlock and safety devices
- Other user friendly features.

Safety Requirements for safe transportation and use of a Laboratory Research Irradiator are;

Mechanical (drop) tests.

- Impact test-9 meter drop test on an unyielding target.
- Puncture test – 1 meter drop on 15 cm diameter punch.

Thermal test.

- Following the above drops, the same package is then subjected to fire test of 800°c for 30 minutes.

Water immersion test.

- The package is subjected to a test of 15 meter or in some cases 200 meter head for about 8 hour.

Acceptance criteria.

After going through the above tests the acceptance criteria is that, the shielding loss due to the cumulative effect of mechanical and thermal tests should not cause radiation level to increase beyond a permissible level as stipulated in the safety codes.

Security and safety against Blast load.

Safety during transportation.

- Blast at a stand of distance of 5 m
- Blast at a stand of distance of 1 m
- Blast against hand grenade.

Safety at site of operation.

- Hiding inside the Gamma Chamber at site.

He concluded by saying that, the GC-5000 & GC-1200 developed by BRIT are not only safe but also secure against potential theft and blast.

13. Dr. S. K. Malhotra, Raja Ramanna Fellow, DAE & Secretary, AEES, Mumbai.

Topic: Public Perceptions about Atomic Energy – Myths Vs Realities.

He reminded us that X-rays were discovered in 1895, and radioactivity discovered in 1896. He said that, after 12 decades, Atomic energy has contributed towards every individuals' life and societal growth.

He regrettably said that, in spite of the immense contribution of atomic energy to overall societal growth, certain sections of the society are either unaware or are indifferent to these contributions.

He further said that, some oppose atomic energy and paint it as a dangerous technology.

Why so?

Because of myths and concerns people have developed like;

Myth: Why Nuclear power at all? Renewables can do the job.

Reality.

- Installed capacity required to reach per capita Electricity Consumption of 5000kWh year.
- Deficit 1094 GWe to be met with Nuclear & Coal.

Myth: Is Nuclear power safe? After all so many accidents have already happened.

Reality: Statistically, Nuclear power plants have the lowest number of accidents and fatalities compared to other industries like petroleum industries.

Myth: What about the radiation and the radioactivity continuously leaking out of the Nuclear Power Plants?

Reality: As we saw the safety and security of a gamma chamber, such safety precautions are taken and all the regulatory bodies ensure minimum acceptable risk of nuclear facilities to the environment.

Myth: Is it not too costly?

Reality: Considering statistical tariff range per unit, Nuclear power has the lowest tariff of Rs 0.97 to 3.94 per unit.

Myth: What about long lived highly radioactive and hazardous Nuclear Waste?

Reality: It is only potentially hazardous, but not really dangerous.

He used a good example to explain this scenario, which said that,

Between potassium Cyanide and Sodium chloride, which is more dangerous? Each one of us said that potassium cyanide is more dangerous.

Then he further asked us, how many people are suffering from high blood pressure as a result of sodium chloride. We then realized that many people suffer and die of high blood pressure.

He then concluded that, Sodium chloride is really dangerous but potassium cyanide is potentially dangerous.

Consequently, he said that, we must learn to differentiate between potential hazards from real hazards.

14. Mr. Akash Mehta. (CEO and co-founder of logic academy & achieve, SIT)

He concluded the National seminar by reminding us of all the topics which the eminent scientists discussed with us.

As the seminar came to an end, Dr. Lalit Varshney's contribution was recognized and felicitated.

The secretary of NAARRI, Mr. P. J. Chandhi was also felicitated.

A vote of thanks was extended to all the eminent scientists and all participants.

A photoshoot session marked the end of the 2- day national seminar.

CONCLUSION.

As a team from GIDC Degree Engineering College, Abrama, we learnt a lot from the scientists and cleared a lot myths.

We appreciated the role of Nuclear energy, Radioisotopes and Radiation technology in our societies and National economic growth & development.

We are grateful to the college administration led by the principle and Heads of Departments for nominating us and facilitating us to attend such an insightful, knowledge enriching, and informative seminar.

Thank you so much.

Yours Sincerely;

PARTICIPATING FACULTY MEMBERS.

Sr.No	Name of faculty member.	Department.
1	Prof. Nilesh Parmar	Civil Engineering Department.
2	Prof. Bruhad. S. Naik	Mechanical Department
3	Prof. Mayur J. Jalnapurkar	Automobile Department
4	Prof. Bhumika Patel	Computer Department.
5	Prof. Jay R. Desai	Electrical Department.

PARTICIPATING STUDENTS.

Sr.No	Name of student.	Enrollment Number.	Department.
1	Trivedi Naineshkumar Vasudevbhai.	151100119124	Mechanical
2	Shimpi Kunal Raju	151100119101	Mechanical
3	Desai Jenil Kiranbhai.	151100119016	Mechanical
4	Natwijuka Gilbert Beyendenza Cyprian.	151100119129	Mechanical
5	Mistry Nisarg.	161100119026	Mechanical
6	Jay Narsi Bhanushali.	151100106015	Civil
7	Mistry Dharmesh Kamlesh	151100106023	Civil
8	Tandel Payalben Viththalbhai	151100106075	Civil
9	Solanki Hemraj Mahendrasinh	151100106053	Civil
10	Makwana Akshay Dalsukhbhai	151100107020	Computer
11	Shah Sanket Sanjay.	151100107053	Computer
12	Panchal Parth	151100107026	Computer

13	Kansara Viraj Nikhil	151100107014	Computer
14	Viresh Golakiya.	151100102008	Automobile
15	Kevin Prajapati.	151100102027	Automobile
16	Divyesh Arvindbhai Patel.	151100109017	Electrical
17	Keyur Pravinbhai Patel	151100109019	Electrical
18	Bhavik Bhupatbhai Tandel.	151100109031	Electrical
19	Darshan Indrasinh Thakor.	151100109036	Electrical

Figure 1: GDEC Team with some of the eminent Scientists.

Figure 2: GDEC Team in the Auditorium.

Figure 3: GDEC Faculty Team.