EARLY HISTORY OF NIST IONIZ. RADIATION PROGRAMS AND CIRMS







"He says if he concentrates hard enough he can remember the golden age of the NBS Radiation Physics Division."

(Copied with a name change only from Punch magazine)

PRESENT NIST GOAL AND STRATEGY





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Ionizing Radiation Division

The strategy for meeting this goal is to develop, maintain, and disseminate the national standards for ionizing radiation and radioactivity to meet national needs for health care, U.S. industry, and homeland security.

Strategic Focus Areas:

- First **Radioactivity Standards** to develop and provide standards for radioactivity based on the SI unit, the becquerel, for homeland security, environmental, medical, and radiation protection applications.
- Second Neutron Standards and Measurements to develop and provide neutron standards and measurements needed for worker protection, nuclear power, homeland security, and fundamental applications.
- Third **Radiation Dosimetry Standards** to develop dosimetric standards for x rays, gamma rays, and electrons based on the SI unit, the gray, for homeland security, medical, radiation processing, and radiation protection applications.

Division home page

GOAL: To provide the foundation of ionizing radiation measurements for our nation.

HISTORY IN THREE TIME PERIODS



- 1928 -- 1945 ESTABLISHMENT OF NCRP & (PERIOD 1) RELATED CONTRIBUTIONS
- 1945 -- 1970 ACQUISITION & RESEARCH (PERIOD 2) WITH TWO BETATRONS & (GOLDEN) SEVEN OTHER SOURCES
- 1970 -- 1988 MISSIONS & SCIENCE (PERIOD 3) WITH LINAC AND OTHER ELECTRON, X-RAY,GAMMA

PERIOD 1: 1928 TO 1945

- 1928 LAURISTON S. TAYLOR WAS HIRED TO MEASURE DOSAGES IN ROENTGENS WITH X & GAMMA RAYS
- 1929 1962 TAYLOR HEADED RADIATION DIV & NCRP AT NBS AND PRODUCED 33 YRS OF RESEARCH AND NCRP REPORTS (1.8 MILLION COPIES OF 149 RPRTS SOLD '31-'05)
- 1945 THEORETICAL PHYSICIST, E.U.CONDON, HIRED AS NBS DIRECTOR



PERIOD 2: 1945 - 1970

- CONDON'S DECISIONS INITIALLY WERE BUDGETARY & ADMINISTRATIVE – ALWAYS WITH NEED AT NBS FOR NEW, MODERN AND FUNDAMENTAL SCIENCE IN MIND
- CONDON & TAYLOR DECIDED ON 50 MEV & 100 MEV BETATRONS FROM G.E. IN '48
- 2 BETATRONS WERE A MAJOR PRIZE FOR NBS SINCE BETATRONS WERE ONLY 7 YRS OLD
- BETATRONS INTENDED TO ADD NEW SCIENCE TO EXISTING NBS PROGRAMS



PER. 2 – HIGH ENERGY RADIATION SECTION



- C & T ESTABLISHED NEW SECTION AND HIRED KOCH AS CHIEF IN 1949
- SIX OTHER "BETATRON" PHD'S ADDED
- AFTER A DECADE, STAFF PRODUCED BALANCED BASIC & MISSION PROGRAM
- THREE EXAMPLES: SYNCHROTRON LIGHT; X RAY SPECTRA; RADIATION PROTECTION AND SHIELDING PROGRM



- KOCH WAS MADE CHIEF OF DIVISION IN '62 WHEN TAYLOR RETIRED. TAYLOR WAS MADE HEAD OF NCRP RELOCATED TO BETHESDA, MD. IN '64.
- 1962 CRITICAL TIME FOR ENTIRE DIVISION WITH PLANNING FOR MOVE TO GAITHERSBURG, MD. DR. J. LEISS PROVIDED MUCH SUPERVISION
- MAJOR DECISIONS: MOVE SYNCHROTRON FOR USE BY DR. R. MADDEN FOR ATOMIC PHYSICS; SURPLUS 50 MEV BETATRON; PURCHASE NEW 140 MEV LINAC, 1.5 MEV DYNAMITRON, 4 MEV VAN de GRAAFF FOR HIGHER INTENSITIES.

PER.2: GAITHERSBURG, MD.



- SCIENCE ARTICLE EXPLAINED SCIENCE & TECHNOLOGY WORKING WITH ELECTRONS.
- KOCH ACCEPTED OFFER AT AIP, NYC, 12/27/66
- DR.RANDY CASWELL, NEW CHIEF, OF RADIATION PHYSICS DIV.; DR. JIM LEISS, CHIEF OF NEW LINAC RADIATION DIV. IN JAN. 1967.

RADIATION PHYSICS LAB SLIDE SHOW IS NEXT



PER. 2: AERIAL VIEW OF NIST







PER. 2: AERIAL VIEW OF RPL



PER. 2: LIST OF FACILITIES

A description of the major facilities of the NBS Radiation Physics Laboratory is essential to an understanding of its research program.

These facilities include:

- A 100-MeV linear electron accelerator (Linac)
- A 4-MeV electron Van de Graaff
- A 2-MeV positive ion Van de Graaff
- A 1.5-MeV electron Dynamitron
- A 500-kV constant-potential accelerator
- Five x-ray machines with maximum potentials of 50 to 250 kV
- A 180-MeV electron synchrotron



PER. 2: 140 MEV LINAC





PER. 2: LINAC BEAM HANDLING





PER. 2: ELECTRON SPECTROMETER



PERIOD 3: 1970 – 1988 SELECTED CLASSIC PUBLICATIONS

- MONTE CARLO CALCULATIONS BY MARTIN BERGER
- DATA COLLECTIONS BY FULLER AND BY HUBBELL
- PROPOSED DOSE STANDARDS USING SEALED WATER CALORIMETERS STARTED BY DOMEN IN 1960'S.
- NUCLEAR PHYSICS: ELECTRON SCATTERING BY LIGHTBODY, PENNER, FIVOZINSKY, GUESTS
- PHOTON, ELECTRON PHYSICS BY DODGE, HAYWARD et al

LINAC DISASSEMBLED JANUARY 1989 AFTER 23 YEARS OF MAJOR CONTRIBUTIONS TO MISSIONS AND SCIENCE IN RADIATION PHYSICS

RADIATION INDUSTRY #1

TABLE 1 - ABSORBED DOSE REQUIRED

- SPROUT INHIBITION
- INSECT DISINFESTATION
- PARASITE CONTROL
- DELAY OF RIPENING
- FUNGI CONTROL
- BACTERIA CONTROL

- 0.1 0.2 KGy
- 0.3 0.5 kGy
- 0.3 0.5 kGy
- 0.5 1.0 kGy
- 1.5 3.0 kGy
- 1.5 3.0 kGy

SOURCE: M. CLELAND

RADIATION INDUSTRY #2

TABLE 2 – ABSORBED DOSE REQUIRED*

- STERILIZATION
- POLYMERIZATION
- GRAFTING
- CROSSLINKING
- DEGRADATION
- **GEMSTONE COLORATION**

15-30 kGy 25-50 kGy 25-50 kGy 50-150 kGy 500-1500 kGy >> 1500 kGy

SOURCE: M. CLELAND

FORMATION OF CIRMS

- CIRMS INCORPORATED IN 1993
- ANNUAL MEETINGS AND WORKSHOPS
- SCIENCE COMMITTEE'S FIRST MEASUREMENT NEEDS REPORT DATED JANUARY 1995; FOURTH NOW AVAILABLE
- RESULT: IMPROVED COUPLING WITH INDUSTRY, FEDERAL & ACADEMIC, PUBLIC
- CIRMS DECLARED EFFECTIVE FOR AND BY NIST

AVAILABILITY OF "EARLY HISTORY"

- PART I : SLIDES (2.5 MB)
- PART 2 : MANUSCRIPT TEXT (61 KB)

• PART 3 : SELECTED-ARTICLE APPENDICES (ABOUT 50 MB)