LA-UR- 98-1055

LA-UR--98-1055
Title:

CONF-980396--

Operational Comparison of Bubble (Super
Heated Drop) Dosimetry with Routine
Albedo TLD for a Selected Group of
Pu-238 Workers

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Submitted to:

Harshaw/NE 1998 TLD Users Group Symposium
San Diego - Mission Valley, California
March 23 - 27, 1998

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Form No. 836 R5
ST 2629 10/91

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Operational Comparison of Bubble (Super Heated Drop) Dosimetry Results with
Routine Albedo Thermoluminescent Dosimetry for a Selected Group of Pu-238
Workers at Los Alamos National Laboratory.

ABSTRACT

Personnel neutron dosimetry continues to be a difficult science due to the lack of availability of robust passive dosimeters that exhibit tissue- or near-tissue-equivalent response. The dosimeter most used for neutron dosimetry in the United States remains the albedo thermoluminescent dosimeter. Other commonly used neutron dosimeters include those based on track-etch and bubble detectors. Albedo thermoluminescent dosimeters are limited in accuracy due to their severe energy dependence. Track-etch and bubble dosimeters generally have a more favorable energy response than albedo dosimeters but are more difficult and expensive to use. This paper is an operational study that compares the use of albedo thermoluminescent dosimeters with bubble dosimeters to determine whether bubble dosimeters do provide a useful daily ALARA tool that can yield measurements close to the dose-of-record.

A group of workers at Los Alamos National Laboratory (LANL) working on the Radioisotopic Thermoelectric Generators (RTG) for the NASA Cassini space

mission wore both bubble dosimeters and albedo dosimeters over a period from 1993 through 1996. The bubble dosimeters were issued and read on a daily basis and the data were used as an ALARA tool. The personal albedo dosimeter was processed on a monthly basis and used as the dose-of-record. The results of this study indicated that cumulative daily bubble dosimetry results agreed with whole-body albedo dosimetry results within about 37% on average. However, it was observed that there is a significant variability of the results on an individual basis both month-to-month and from one individual to another. Some possible explanations of the differences are offered in this paper. In addition, some of the technical basis studies that were performed in developing the bubble dosimetry program at LANL are summarized.

1.0 Neutron Dosimetry Needs at Los Alamos National Laboratory

1.1 Neutron Energies Encountered

Los Alamos National Laboratory (LANL) is a large multi-discipline research institution that utilizes a wide variety of radioactive materials and radiation producing machines in the pursuit of its research and development missions. Neutron radiation is a major portion of the Laboratory's collective dose accounting for about 75% of the approximately 200 person-rem incurred each year. The sources of neutron radiation range from highly moderated sources around critical

assemblies (TA-18) and in the plutonium facility (TA-55) to very high-energy neutrons (up to 800 MeV) which are accelerator produced at the Los Alamos Neutron Science Center (TA-53). Included in the operations at the LANL plutonium facility (TA-55) is the production of Radioisotopic Thermoelectric Generators (RTGs) for power sources for NASA. These power sources are made of Pu-238 which have neutron spectra that vary during the production operations but yield a maximum neutron energy of about 5 MeV.

LANL utilizes both whole-body thermoluminescent dosimetry and track-etch dosimetry for the dose-of-record throughout the Laboratory. For ALARA purposes, LANL uses supplemental neutron dosimeters to provide nearly real-time feedback on personnel exposure. These supplemental neutron dosimeters are either super heated drop (bubble) or electronic based. The electronic based self-reading pocket neutron dosimeter utilized at LANL is manufactured by Aloka (reference) and operates using a silicon diode detector. The Aloka self-reading neutron dosimeter has been shown in LANL technical basis studies to have a significant energy dependence that is similar to albedo TLD but is a useful ALARA tool (Harris et al., 1995).

This study focuses on the neutron dosimetry needs of a particular organization within LANL. Specifically, daily bubble dosimeter results are compared to whole-body TLD neutron results for the LANL Pu-238 operations for the period from 1993 through 1996. Neither bubble dosimeters nor albedo TLDs are perfect dose

equivalent dosimeters and the advantages and limitations of each type is discussed in this work.

1.2 Pu-238 Operations

The Actinides Ceramics Group at the Los Alamos National Laboratory TA-55 Plutonium Facility processes plutonium oxide into heat sources for terrestrial and space applications. Typical feed is enriched in the ^{238}Pu isotope to approximately 80%, with approximately 15% ^{239}Pu and the remainder plutonium isotopes 240, 241, and 242. Characterization and processing steps include calorimetry and analysis of incoming feed, Oxygen-16 exchange, ball-milling, slugging and screening, granule seasoning, hot pressing, post sintering, encapsulation, nondestructive testing, and preparation for shipment.

During the initial calorimetry step, the fuel is encased in two stainless steel shipping containers and handling is done with minimal shielding. At this point, the fuel is exhibiting a large neutron emission rate of high-energy neutrons with a maximum energy of approximately 5 MeV. Typical dose rate measurements at contact with the shipping container are 200 mrad/hr gamma and 75 mrem/hr neutron radiation. Once calorimetry is completed, the fuel is then introduced into the glovebox line, which is shielded with lead, water, and Plexiglas. The gloveboxes are constructed with stainless steel-lead-stainless steel sandwich-type walls and have highly polished interiors to facilitate cleaning. Glovebox windows are safety glass held in

position by Viton gaskets that are provided with stainless steel fire shields. The gloves consist of two layers of Hypalon separated by a thin layer of lead. Neutron attenuation is provided by 4 inches of hydrogenous shielding located outside the glovebox. Photos of the shipping container and glovebox operations are provided in Figure 1.

When the Pu-238 fuel is initially received the neutron emission rate is on the order of 20,000 n/sec/gm and the neutron spectrum is dominated by the high-energy neutrons with a maximum energy of 5 MeV associated with alpha-n reactions. In the first processing step, called Oxygen exchange, the fuel is heated in argon gas saturated with water enriched in Oxygen-16 to replace the Oxygen-17 and Oxygen-18. The Oxygen-17 and Oxygen-18 impurities cause the large neutron emission due to their very high (alpha,n) reaction cross sections. Oxygen-16 has an insignificant (alpha,n) reaction cross section and replacing the O-17 and O-18 with O-16 drastically reduces the neutron emission rate and hence the personnel dose equivalent. In theory, the minimum possible neutron emission rate is set by the spontaneous fission rate, 2880 n/s-g Pu-238. In practice, minimum emission rates near 4500 n/s-g are obtained in the Oxygen exchange process. Following Oxygen exchange, the neutron emission rate is reduced to the lower intensity and is now dominated by the spontaneous fission of Pu-238 which produces neutrons of a much lower average energy of around 1 - 2 MeV.

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Figure 1. Pu-238 Operations Handling Shipping Containers and Working on Glovebox.

After several thermal and mechanical treatment steps, the fuel is in the form of a pressed pellet which is encapsulated in an iridium alloy shell approximately 0.6 mm thick. After encapsulation, the general-purpose heat source is removed from the glovebox line, decontaminated, characterized by several nondestructive test methods, and packaged for shipment. The increased plutonium processing activity throughput beginning in 1993 as a result of the NASA Cassini mission resulted in higher occupational neutron doses making worthwhile added monitoring efforts for ALARA purposes. Workers wore supplemental bubble dosimeters, in addition to routine whole-body TLDs, and exchanged them on a daily basis for monitoring neutron doses from 1993 through 1996. The whole-body TLD was, and is still currently, used as the dose-of-record.

2. Whole-body Thermoluminescent Dosimetry at LANL

2.1 Early Neutron Dosimetry (since 1980)

Los Alamos National Laboratory utilizes a Harshaw/Bicron Model BGN-7776 whole-body thermoluminescent dosimeter (TLD) for performing routine external radiation dosimetry. This dosimeter is regularly tested and approved by the Department of Energy Laboratory Accreditation Program (DOELAP) for external dosimetry systems. The dosimeter is made up of four TLD elements placed behind different filter materials and thicknesses. The first three TLD elements are lithium fluoride

(doped with Mg and Ti) enriched in Lithium-7 (Harshaw/Bicron Model TLD-700) while the fourth TLD element is lithium fluoride (doped with Mg and Ti) enriched in Lithium-6 (Harshaw/Bicron Model TLD-600). Lithium-6 has a thermal neutron absorption cross section of 942 barns (and exhibits a $1/v$ energy dependence) while Lithium-7 has a negligible neutron cross section. The BGN-7776 whole-body dosimeter and associated elements and filtration are shown in Figure 2.

Figure 2. LANL BGN-7776 Whole-Body Dosimeter.

The albedo neutron dosimeter is located in positions three and four with the paired TLD-600 and TLD-700 elements under identical plastic filtration (reference Harshaw/Bicron Corporation). The TLD-600 and TLD-700 dosimeter materials exhibit equivalent photon response while TLD-600 is also sensitive to thermal neutrons and TLD-700 is insensitive to them. Plastic filtration is used as a non-neutron absorbing mechanical media that is identical for both elements. This is actually a quasi-albedo dosimeter since there is not a thermal neutron absorbing filter over the top of this TLD element pair. Therefore, the TLD-600 in the LANL Model BGN-7776 dosimeter will respond to both incident thermal neutrons as well as albedo neutrons (which are thermal neutrons produced from higher energy neutrons moderated to thermal energies and reflected from the body).

Since the albedo dosimeter only responds to incident and reflected thermal neutrons, this dosimeter exhibits a highly energy dependent response relative to that for dose deposition in the human body. The LANL Model BGN-7776 albedo dosimeter relies on the use of Neutron Correction Factors (NCFs) to modify its energy dependent response to estimate neutron dose in tissue.

2.2 Neutron Correction Factors for the Albedo Neutron Dosimeter

All four TLD elements are equally sensitive to photon radiation and are, therefore, calibrated with Cs-137 using automated Harshaw/Bicron Model 6610C TLD calibrators. The gamma calibration of the neutron sensitive element, TLD-600 in

position 4, must be modified to estimate neutron dose with the use of location-specific neutron correction factors. NCFs are multipliers which convert the gamma-equivalent nC TLD output to true neutron dose for a given neutron spectrum. Location-specific factors are required because the neutron spectra can vary significantly for various locations within a given facility. NCFs for the LANL Model BGN-7776 albedo dosimeter can easily vary by more than an order of magnitude (less than 0.1 to greater than 1.0) for neutron sources and geometries encountered at the laboratory. NCFs for very highly moderated neutron sources at the LANL plutonium facility (TA-55) have been measured to be less than 0.1 while NCFs for bare isotopic sources such as PuBe are on the order of greater than 1.3 (Casson et al. 1995). NCFs at LANL from 1980 until late 1995 were static factors assigned to an employee based on work location. Each employee had only one factor that was based on job location and an employee's NCF was changed typically only when the employee's job changed or NCFs were updated for the area where the employee worked. Beginning in late 1995 a new whole-body dosimeter, called the Model 8823 dosimeter, was introduced that allowed for the on-board calculation of an integrated NCF to be applied to the existing albedo dosimeter. This will be discussed in more detail later.

The primary method for determining NCFs from 1980 to 1995 at LANL was by the use of an Eberline 9" NRD "rem-meter", a 40x40x15 cm Lucite phantom, a cart, and a set of Model BGN-7776 dosimeters. Figure 3 shows the instrument configuration that was used for determining location-specific NCFs. The 9" NRD was operated in

the integrating mode and the reading of this instrument, although itself not completely tissue-equivalent because it exhibits a significant over-response in the several hundred keV region, was, nevertheless, assumed to be the true value.

Figure 3. Instrument Configuration for Neutron Correction Factor Measurements.

The readings on the set of Model BGN-7776 dosimeters on-phantom near to the 9" NRD were averaged and the NCF for each location was taken to be the quotient of the 9" NRD result to the average of the Model BGN-7776 dosimeter results.

One major failing of static NCFs is the fact that employees do not remain at one work location nor do the work processes remain constant. For this reason, NCFs have traditionally been conservatively assigned at LANL. This fact has been reported in several LANL publications (Casson et al. 1995, Harvey et al. 1993, Hoffman et al. 1992).

2.3 Contemporary Neutron Dosimetry

The Model 8823 whole-body dosimeter is an improved design that will fully replace the Model BGN-7776 dosimeter for the dose-of-record at Los Alamos National Laboratory in 1998. LANL began using the Model 8823 dosimeter in late 1995 in combination with the standard Model BGN-7776 dosimeter strictly for the purpose of determining NCFs. The Model 8823 dosimeter has the capability to calculate an integrated NCF and has replaced the use of static NCFs at TA-55 as were described in Section 2.2. The Department of Energy Laboratory Accreditation Program (DOELAP) for external dosimetry systems granted approval of the change in NCF technique for Los Alamos National Laboratory.

The Model 8823 dosimeter contains two TLD cards; one for beta and photon dosimetry and the other for neutron dosimetry. The neutron TLD card contains two pairs of TLD-600, -700 elements. One pair is fully surrounded by cadmium except there is an open area covered only by plastic toward the body in the classic Hankins-type albedo dosimeter design. The other pair is fully surrounded by

Figure 4. Model 8823 Whole-body TLD Showing Placement of the Cadmium Filter with Open Window Over Positions 5 and 6 and Under Positions 7 and 8.

cadmium except there is an open area covered only by plastic facing away from the body (called an anti-albedo). Figure 4 shows the holder of the Model 8823 dosimeter where the pairs of TLD-600, -700 elements are placed in positions 5 and 6 for the anti-albedo dosimeter and positions 7 and 8 for the albedo dosimeter. An empirically derived function exists to calculate an integrated NCF using the net-neutron responses of the albedo and anti-albedo elements in the model 8823 dosimeter. The gamma signal is subtracted from the TLD-600 readings in positions 5 and 8 using the corresponding TLD-700 readings in positions 6 and 7 to yield net-

neutron responses for the albedo and anti-albedo dosimeters. The ratio of the albedo to anti-albedo net neutron results yields an indication of the appropriate NCF to be applied. This calculated NCF was applied to the readings on the corresponding Model BGN-7776 dosimeter (Casson et al. 1995).

The Model 8823 dosimeter will fully replace the Model BGN-7776 dosimeter as the stand-alone whole-body dosimeter at Los Alamos National Laboratory in 1998.

3.0 Bubble Dosimetry

3.1 Development

In 1952, Glaser discovered that some liquids become radiosensitive while in a superheated state (Glaser, 1952). Lowering the pressure of the bubble chamber containing a liquid below the vapor pressure of the liquid would result in a superheated or metastable state that renders it radiosensitive for detection. Ionizing radiation deposits energy in a localized volume of the superheated liquid that is sufficient to cause bubble formation. Seitz further developed the theory on bubble formation (Seitz, 1958) called the "thermal spike" model. He introduced the concept that there exists some critical radius for a vapor bubble embryo that once this radius is reached the bubble embryo will continue to grow by evaporation of superheated fluid until it reaches equilibrium size. A bubble embryo that does not exceed the critical radius will return to the liquid phase. The minimum energy locally deposited

by ionizing radiation required to produce a bubble embryo of critical radius depends on surface tension and pressure, of which both are a function of temperature. The minimum energy, therefore, can be shown to be inversely proportional to temperature.

By applying sufficient pressure within the chamber bubbles can be recompressed, transferring them back to the liquid phase. Since the work of Glasser many studies have since been carried out using this technology to detect radiation (Ing et al., 1997; Kahn and Peacock, 1963; West and Howlett, 1968).

Commercial suppliers of neutron dosimeters that utilize super heated drop technology include Bubble Technology Industries (BTI) and Apfel Enterprises Inc. Los Alamos National Laboratory chose to use BTI as the supplier for bubble neutron dosimeters during this study period (1993 - 1996). For this reason, this report focuses on this unique technology as it is applied by BTI but the author (nor LANL) does not endorse or reject the products of either manufacturer of super heated drop dosimeters.

3.2 Characteristics

The BTI bubble dosimeter is a passive, reusable, neutron dosimeter that allows instant visible detection of neutron radiation. It is lightweight and compact so that it can be worn on a lab coat or an area of limited space and hence is useful for

personal monitoring. The dosimeter is unresponsive to gamma radiation and consists of droplets of superheated liquid dispersed in a transparent elastic polymer or media. When ionization occurs in the vicinity of these droplets small bubbles form that remain in the polymer and provide an immediate visual record of the dose. The number of bubbles is proportional to the neutron dose. The detectors are tissue equivalent and have an isotropic response so neutron doses are recorded accurately regardless of the neutron direction relative to the detector. Bubble dosimeters have been used in diverse applications associated with the measurement of radiation neutron exposure to airline pilots, the measurement of neutron fields inside satellites in outer space and the legal dose of record for neutron exposures in some European countries.

3.3 Types of Bubble Dosimeters

Bubble Technologies Industries (BTI) has developed several types of bubble dosimeters. Each is described briefly below with information taken from the BTI product literature.

BDT: The BDT dosimeter is a thermal neutron detector. It is temperature compensated over the temperature range 20-37°C and is completely insensitive to gamma radiation. The detector response is tissue equivalent and its sensitivity to thermal neutrons is 10 times that to high energy neutrons.

BD-PND: The BD-PND is a bubble neutron dosimeter with performance exceeding legal neutron dosimeters. The absorbed dose of neutrons is easy to determine, either by a visual count or by use of an automatic reader. Insensitive to gamma radiation, the BD-PND offers high neutron sensitivity, zero humidity effects and is insensitive to temperature variations. The PND is a useful tool for controlling and monitoring neutron exposures to personnel; background measurements and the planning phases of high exposure maintenance and for the selection of dose reduction strategies.

BD-100R: The BD-100R is two orders of magnitude more sensitive than any other commercial neutron detector and has a flat energy response from about 22 keV to 14 MeV. The BD-100R gives a visual response to neutron fields and no chemical or mechanical processing is required to assay the dose absorbed. The BD-100R can be used under water with no effect on performance and is completely isotropic in its angular response to neutrons. The BD-100R bubble detector provides a useful tool for area monitoring and checks of neutron shielding and leakage.

BDS: The BDS bubble dosimeter is a complete spectrometer package consisting of 36 neutron bubble detectors. The detectors can be reset using an optional hydrostatic recompression chamber (RC-18) and can be used 10 times. The BDS spectrometer will be of interest to researchers and dosimetrists who have

a need to characterize neutron fields in nuclear utilities, facilities handling fissile materials and accelerator laboratories.

Each spectral measurement is made using 18 bubble detectors. Six sets of three each detectors have thresholds of 10, 100, 600, 1000, 2500, and 10,000 keV, which allow a range from 10 keV to 15 MeV to be covered.

The BDS is particularly suited for determining the spectral distribution of neutron fields thereby assisting in the choice of neutron dosimeters to be worn by workers exposed to the fields. Before using the BDS, dosimetrists and researchers should make an assessment of expected dose rates using the BD-100R detector. This allows the creation of an appropriate BDS deployment plan that ensures statistically significant data, especially in the high energy range.

3.4 Calibration of Bubble Dosimeters at LANL

The BD-PND and BD-100R bubble dosimeters were read on the BTI BDR-Series II evaluation system. This reading system utilizes light illumination of the bubble dosimeter tube that is captured on a camera. The image is transferred to a personal computer where automated analysis allows discrimination for acceptable bubbles based on size and shape. The evaluation system was configured according to the instructions in the user's manual. All bubble dosimeters were calibrated on a 40x40x15 cm Lucite phantom at 50 cm from a bare ^{252}Cf source to

about 20 mrem. The level of 20 mrem was chosen as the calibration value because this level was high enough that it could be accurately delivered in the LANL calibration facility but low enough so that it would not saturate the bubble dosimeters. Bubble dosimeters could not be accurately processed in the reading system beyond about 600 bubbles due to image saturation. Typical BTI BD-100R bubble dosimeters ranged in sensitivity from 1.2 to 20 bubbles per mrem.

During calibration, three irradiations were made for each dosimeter with the stated geometry and the dosimeters were read the day following irradiation. Bubble dosimeters were observed to register an increased sensitivity of about 10% by waiting to read at least 16 hours following irradiation. This is presumably due to the growth of radiation induced smaller bubbles to measurable size over time. A temperature correction was made using manufacturer supplied data, shown in Figure 5, for uncompensated dosimeters (BD-100R). The BTI temperature compensated bubble dosimeter (BD-PND) offers much improved temperature independence and its temperature response is also shown in Figure 5. The results of the three irradiations were averaged to yield a mean individual sensitivity correction factor (bubbles counted per mrem delivered) for each dosimeter. Each dosimeter had an average sensitivity correction factor that had a relative error of less than 10%.

Each time the bubble dosimeter is processed at LANL in the BDR-Series II evaluation system, it is read three times with a partial rotation of about 120 degrees

Figure 5. Temperature Dependence of BD-100R and BD-PND Bubble Dosimeters. (Source: Bubble Technology Industries).

of the dosimeter between readings. The results of the three readings yield an average bubble count which is divided by the individual sensitivity correction factor that was determined during calibration and a temperature correction is applied for the BD-100R dosimeters to yield the neutron dose in mrem. BD-PND dosimeters require no temperature correction for normal workplace conditions. LANL calibrates on-phantom with bare ^{252}Cf (dose weighted average energy ~ 2.3 MeV) while BTI calibrates "free-in-air" using a bare AmBe source (dose weighted average energy ~ 4.4 MeV). A Monte Carlo calculation was performed at LANL (Hoffman et al., 1992) using MCNP(version 4.2), the two source spectra, and the published BD-100R response function to determine if there is an expected difference in the above two calibration conditions. The AmBe "free-in-air" calculation was performed using a 1 cm Lucite simulated bubble dosimeter to approximate the interference of the dosimeters themselves. According to the calculations, it was found that the LANL

calibration conditions would result in a 5% lower response than the BTI conditions.

The calibration that was applied to all bubble dosimetry data produced at LANL was based only on the LANL calibration. The energy response curve of the BD-100R Bubble Detector is shown in Figure 6 from manufacturer supplied data (Bubble Technology Industries).

LANL has observed a small difference between irradiation's performed on-phantom and those performed free-in-air (Hoffman et al., 1992). In this study fifteen BD-100R dosimeters (12 bubbles/mrem) were irradiated: eight free-in-air and seven on-phantom. The dosimeters were irradiated with bare ^{252}Cf to 15.3 mrem and read immediately following irradiation and again at 24 and 48 hours. The repeated

Figure 6. Neutron Energy Dependence of BD-100R Bubble Dosimeters. (Source: Bubble Technology Industries).

readings were performed to examine the effect of change in sensitivity versus time as a function of geometry (i.e., on-phantom verses free-in air). The results showed the average sensitivity increased 10% within 24 hours and nearly 15% in 48 hours for the free-in-air case. The average sensitivity increased 10% within 24 hours and about 14% in 48 hours for the on-phantom case. Change in sensitivity is not significantly different between free-in-air and on-phantom geometries. Based on this study, bubble dosimeters were normally processed on the day following irradiation.

4.0 Experimental Performance of Bubble Dosimeters

4.1 Deviation of Relative Sensitivity with Dose

Since the bubble dosimeters used at LANL were for field operational use, the dosimeters were expected to be exposed over a range of 0 to 25 mrem per day. The bubble dosimeters were produced by the vendor with sensitivity ranging from 1 to 25 bubbles/mrem and could be procured in vendor specified sensitivity groups of low (1 to 6 bubbles/mrem), medium (6 to 12 bubbles/mrem), and high (greater than 12 bubbles/mrem) sensitivity. The author performed a study to examine the deviation in relative sensitivity of the bubble dosimeters over the anticipated occupational dose range for the various sensitivities of bubble dosimeters by usage level. Four groups of bubble dosimeters were evaluated. Group 1 was a set of

Model BD-100R dosimeters that were routinely being used at TA-55, the Plutonium Facility. Group 2 was a set of Model BD-100R dosimeters that were occasionally being used at TA-18, the Critical Assemblies Facility. Group 3 was a set of Model BD-100R dosimeters that had only been used for calibration. Group 4 was a set of temperature compensated Model BD-PND bubble dosimeters. Both BD-100R and BD-PND dosimeters were studied because BD-100R were initially used at LANL but were eventually replaced with BD-PND during the period of operations covered in this report.

The effect of reading the same dosimeters on different reader systems was also examined by reading all dosimeters first on the bubble reader at TA-55 (Reader #1), and again on the other bubble reader located at SM-1898 Calibration Facility, (Reader #2).

All dosimeters were calibrated as previously described to 20 mrem bare Cf-252. The dosimeters were then irradiated to doses of 5, 10, 15, 20 and 25 mrem and processed on each reader system, and reset. All data from this study are contained in Appendix A.

Group 1 consisted of BD-100R dosimeters that were divided into a set of high (16 - 22) and a set of low (1.2 - 5.3 bubbles/mrem) sensitivity of which all had been used routinely. The results of the deviation from linearity study for Group 1 are shown below in Figure 7. Shown in Figure 7 are the average readings for the dosimeters

normalized to their 20 mrem calibration with error bars plus and minus one sigma of the mean. These data are taken from columns 12 – 15 for the TA-55 bubble reader (Reader #1) and columns 24 – 27 for the SM-1898 bubble reader (Reader #2) from Appendix A, page A-1, where zero readings due to failed dosimeters were ignored. It was observed that a significant over-response occurred on the order of 80 to 100 percent for the high sensitivity BD-100R bubble dosimeters at the 5 mrem level relative to the 20 mrem calibration. The low sensitivity bubble dosimeters exhibited about a 40% over-response at 5 mrem relative to the 20 mrem calibration. The over-response is possibly due to a more efficient counting by the bubble reader's image analysis system when few bubbles are present. The bubble reading systems are apparently more efficient at counting nearly all bubbles present in the low sensitivity dosimeters over the entire dose range when compared to the high sensitivity dosimeters relative to the 20 mrem calibration. The high sensitivity dosimeters exhibit an increasing loss of counting events beyond the 5 mrem level over the entire dose range. This is presumably due to overlapping of bubbles on the two-dimensional image during automated analysis. For this reason, the low sensitivity bubble dosimeters exhibited the least deviation from a relative sensitivity of 1.0 over the range of 5 to 25 mrem for Group 1.

The mean values of the relative sensitivity were consistently within two sigma for each sensitivity class when read on different reader systems. This indicates that for

Figure 7. Results of Deviation in Relative Sensitivity Study for Group 1, BD-100R Bubble Dosimeters Used Routinely at TA-55.

Group 1, the reader systems produced essentially equivalent results whether the dosimeters were processed on Reader #1 or Reader #2. Group 2 consisted of BD-100R dosimeters that were divided into a set of high (16 - 22) and a set of low (1.2 - 2.4 bubbles/mrem) sensitivity and had been used only occasionally. The results of the linearity study for Group 2 are shown below in Figure 8. Shown in Figure 8 are the average readings for the dosimeters normalized to their 20 mrem calibration with error bars plus and minus one sigma of the mean. These data are taken from columns 12 - 15 for the TA-55 bubble reader (Reader #1) and columns 24 - 27 for the SM-1898 bubble reader (Reader #2) from Appendix A, page A-2, where zero readings due to failed dosimeters were ignored. It was observed that a significant over-response occurred on the order of 60 to 80 percent for the high sensitivity BD-100R bubble dosimeters at the 5 mrem level relative to the 20 mrem calibration. The

over-response at 5 mrem for the high sensitivity set in Group 2 appeared to be slightly dependent on the reader system used in processing, where Reader #1 showed a larger over-response than did Reader #2. At higher dose levels the results were equivalent (within two sigma of the mean) when the dosimeters were processed on the different reader systems.

The low sensitivity bubble dosimeters exhibited an essentially constant sensitivity over the range of 5 to 25 mrem relative to the 20 mrem calibration. The Group 2 low sensitivity dosimeters did not exhibit an over-response similar to the corresponding set in Group 1 because the Group 2 set had a lower maximum sensitivity (2.4 vs 5.3 bubbles/mrem) thereby having less of a loss of counting events at the higher dose

Figure 8. Results of Deviation in Relative Sensitivity Study for Group 2, BD-100R Bubble Dosimeters Used Occasionally at TA-18, Critical Assemblies Facility. values. In general, the lower the sensitivity the less over-response is observed at

the 5 mrem level relative to the 20 mrem calibration value. Group 3 consisted of BD-100R dosimeters that were divided into a set of high (17 - 22) and a set of low (1.3 - 5.0 bubbles/mrem) sensitivity and had been used only occasionally for calibration purposes. The results of the linearity study for Group 3

are shown below in Figure 9. Shown in Figure 9 are the average readings for the dosimeters normalized to their 20 mrem calibration with error bars plus and minus one sigma of the mean. These data are taken from columns 12 – 15 for the TA-55 bubble reader (Reader #1) and columns 24 – 27 for the SM-1898 bubble reader

(Reader #2) from Appendix A, page A-3, where zero readings due to failed dosimeters were ignored. It was observed that a significant over-response occurred on the order of 50 to 80 percent for the high sensitivity BD-100R bubble dosimeters

Figure 9. Results of Deviation in Relative Sensitivity Study for Group 3, BD-100R Bubble Dosimeters Used Only for Calibration Purposes at TA-3 Calibration Facility.

at the 5 mrem level. The over response at the lower dose levels for this set was dependent on the reader system used in processing with Reader #1 showing the larger over response than Reader #2. There was also observed an over-response of the low sensitivity bubble dosimeters of 30 to 40 percent which is in agreement with the results for Group 1 that had a similar sensitivity profile for this set.

Group 4 consisted of a set of medium sensitivity (6.0 - 9.6 bubbles/mrem) temperature compensated BD-PND bubble dosimeters. The results for the linearity study for Group 4 are shown below in Figure 10. Shown in Figure 10 are the average readings for the dosimeters normalized to their 20 mrem calibration with error bars plus and minus one sigma of the mean. These data are taken from columns 12 – 15 for the TA-55 bubble reader (Reader #1) and columns 24 – 27 for the SM-1898 bubble reader (Reader #2) from Appendix A, page A-4, where zero readings due to failed dosimeters were ignored. Group 4 exhibited an over response at the 5 mrem level relative to the 20 mrem calibration from 10 to 35 percent. The linearity observed for Group 4 was slightly reader system dependent where Reader #1 exhibited more over response than Reader #2 at the low dose levels.

The conclusion of this study is that the low and medium sensitivity bubble dosimeters offer the least deviation in relative sensitivity over the occupational dose

range of concern from 5 to 25 mrem. Bubble dosimeters are expected to over respond at doses that are less than their calibration due to the increased counting efficiency observed when fewer counting events are present. This phenomenon is important in the analysis of the operational field data that follows in Section 5.

Figure 10. Results of Deviation in Relative Sensitivity Study for Group 4, Temperature Compensated BD-PND Bubble Dosimeters Used for Calibration Purposes at TA-3 Calibration Facility.

4.2 Longevity

The manufacturer warrants the BTI bubble dosimeters used at LANL for three months based on expected daily use. Bubble dosimeters were used at LANL from receipt calibration until there were several bubbles present in the dosimeter that could no longer be recompressed. It was found that the BD-100R (non-temperature compensated) dosimeters would last about six to ten months. Table 1 provides the

longer life when not used on a frequent basis. Longevity was not significantly dependent on sensitivity of the detector.

Table 1. Longevity of Bubble Dosimeters.

	% SURVIVING		
	6 MONTHS	9 MONTHS	10 MONTHS
Group 1 Used Routinely N=50	64%	8%	0%
Group 2 Used Occasionally N=38	97%	84%	5%
Group 3 Used Rarely N=27	96%	85%	18%

4.3 Stability

The bubble dosimeters are relatively stable passive dosimeters especially when compared to electronic self-reading dosimeters. However, bubble dosimeters are subject to a shock induced response. Bubbles form in the dosimeter when dropped or thrown onto a hard surface but the bubble events are discernible from radiation induced events in that the bubble formations are non-uniform and are concentrated near the point of shock. Careful analysis of a shock induced reading can usually resolve a dose estimate.

4.4 Background

A study at LANL determined the background response of bubble dosimeters is very low which enhances the lower-limit-of-detection (Hoffman, et al., 1992). Six high sensitivity (12 bubbles/ mrem) and six low sensitivity (1.2 bubbles/mrem) BD-100R bubble dosimeters were allowed to sit sensitized, but not in a radiation field, for 18 hours. After this period of equilibration, the high sensitivity dosimeters each had one or two bubbles while the low sensitivity dosimeters each had zero or one bubble.

Also one high sensitivity dosimeter was sensitized and allowed to sit in a background field for 230 hours (9.5 days). It registered eight bubbles of varying size. The sizes ranged from about 1 mm diameter to about 5 mm diameter. Since the background response is so low and the dosimeters are normally read daily, usually no background subtraction is performed at LANL.

4.5 Low Energy Neutron Response Check at LANL

The energy response of the BTI bubble dosimeter is shown in the vendor supplied response function that was shown previously in Figure 5. Bubble dosimeters have a favorable neutron energy response from about 200 keV to several MeV when calibrated with a spontaneous fission source such as ^{252}Cf . In order to verify the energy response of the bubble dosimeters utilized at LANL a low energy response check was made with various sources, both isotopic and moderated (Hoffman et al. 1992). The results of this study are shown below in Table 2.

Table 2. Low Energy Neutron Response Check.

Source	Relative Results	Delivered Dose (mrem)
Cf-252 4" Lucite moderated	0.97 ± 0.04	20
Cf-252 6" Lucite moderated	0.96 ± 0.05	11
Bare Cf-252	1.00 ± 0.07	50
Cf-252 D2O moderated	1.00 ± 0.07	60

4.6 Limitations

Bubble dosimeters are very sensitive to neutron radiation and offer a very favorable energy response function, however, several limitations of these devices have prevented more widespread use in the United States. These limitations include: (1) they are relatively expensive compared to TLDs, (2) their applicable dose range is quite limited which is an issue with accrediting agencies, (3) the bubble dosimeters require significant maintenance with regard to daily processing, (4) bubble dosimeters are sensitive to mechanical shock, and (5) have a relatively short shelf-life.

5.0 Operational Comparison of Bubble Dosimeters with Whole-Body TLDs

Bubble dosimeters were issued on a daily basis to employees of NMT-9 who were producing the Radioisotopic Thermoelectric Generators (RTGs) from 1993 to 1996 for NASA's Cassini space mission. Data on the daily bubble dosimeter readings for

employees were collected and reported to ALARA personnel in NMT-9. Some employees worked for NMT-9 during this entire period of time while others came on and/or left the project during this period. The data for the daily bubble dosimeter readings collected for each employee are presented in Appendix B. These data are labeled with random employee numbers because of the sensitive nature of this personnel information. The daily bubble dosimeter readings were summed for each month and compared to the monthly whole-body TLD readings and these data are available in Appendix C. The cumulative monthly results were tabulated and are presented below in Table 3 as an overall comparison for the entire monitoring period. It was found that the average of the absolute values of the percent difference of the two measurement systems (Table 3, column 4) was 25%. As evident from column 4 of Table 3 significant variations on the TLD and bubble dosimeter agreement occurred on an individual basis.

For cumulative doses exceeding 100 mrem, the bubble dosimetry results were within 50% of the TLD results with a couple of exceptions. Column 5 of Table 3 indicates the NCF or range of NCFs used in the whole-body TLD neutron assignments. The degree of agreement between the two measurement systems is a result of: (1) a combination of technical limitations of each measurement system, (2) the diligence of the employees in donning the daily bubble dosimeters, (3) the difficulty in maintaining static NCFs during part of the monitoring period, (4) the appropriateness of the assigned NCF during the monitoring period, and (5) the accuracy of an integrated NCF.

Table 3. Cumulative TLD and Bubble Dosimetry Results by Employee for the Entire Monitoring Period (1993 - 1996).

	TLD	Bubble	Percent	
	Neutron	Neutron	Difference	Range of
Individual	Dose (mrem)	Dose (mrem)	From TLD	NCFs
EMP1	234	138	-41.03	0.4
EMP2	2460	2633	7.03	0.2
EMP3	804	532	-33.83	0.2, 0.4, 0.7
EMP4	691	1037	50.07	0.4, 0.5, ~0.20
EMP5	0	17		0.4
EMP6	1046	873	-16.54	0.21, 0.4
EMP7	282	188	-33.33	0.2, 0.4
EMP8	892	1047	17.38	~0.20
EMP9	489	731	49.49	0.5, ~0.20
EMP10	2155	1706	-20.84	~0.20
EMP11	20	15	-25.00	0.4
EMP12	288	254	-11.81	0.2
EMP13	2266	2202	-2.82	0.4, 0.7, ~0.20
EMP14	1235	1554	25.83	0.4, ~0.21
EMP15	41	34	-17.07	0.4
EMP16	1045	1068	2.20	0.2
EMP17	1247	1387	11.23	0.5, 0.4, ~0.25
EMP18	2370	2546	7.43	0.4, ~0.21
EMP19	461	757	64.21	0.4, ~0.24
EMP20	1789	2384	33.26	0.2, 0.5
EMP21	1790	1602	-10.50	0.2, 0.21
EMP22	22	22	0.00	0.2
EMP23	250	171	-31.60	0.4
EMP24	13	28	115.38	0.2
EMP25	21	67	219.05	0.2
EMP26	1423	1894	33.10	0.4, ~0.24
EMP27	2343	2605	11.18	0.2, 0.3
EMP28	119	125	5.04	0.4
EMP29	1286	934	-27.37	0.2, 0.5
EMP30	2376	2519	6.02	0.4, 0.20
EMP31	285	313	9.82	0.2
EMP32	1122	981	-12.57	0.2
EMP33	1319	1306	-0.99	0.2
EMP34	253	182	-28.06	0.4
EMP35	60	89	48.33	0.2
EMP36	2142	2188	2.15	~0.21

Table 3. (continued)				
Individual	TLD (mrem)	Bubble (mrem)	Percent Difference	Range of NCFs
EMP37	169	180	6.51	0.2
EMP38	591	555	-6.09	0.4
EMP39	556	512	-7.91	0.4
EMP40	1337	1585	18.55	0.2
EMP41	1551	1077	-30.56	0.2, 0.4
EMP42	365	202	-44.66	0.4
EMP43	188	208	10.64	0.4
EMP44	1016	897	-11.71	0.4
EMP45	84	114	35.71	0.2, 0.5
EMP46	1597	1670	4.57	0.7, 0.4, ~0.21
EMP47	1876	1373	-26.81	0.4, ~0.21
EMP48	875	848	-3.09	0.2
EMP49	0	0.3		0.5
EMP50	974	1049	7.70	0.2
EMP51	1849	2364	27.85	~0.20
EMP52	2194	2490	13.49	0.3, 0.4, 0.2
EMP53	58	54	-6.90	0.4
EMP54	1354	1448	6.94	0.2
EMP55	1926	2308	19.83	0.2
EMP56	1262	929	-26.39	0.2, 0.4
Total	54461	55992	* 393	
Average	972	1000	* 7.3	
Variance	629363	733588	* 1697	
Std Deviation	793	856	* 41	

* Excludes EMP5 and EMP49

The results of Table 3 are presented in a scatter plot format in Figure 11. Figure 11 shows that there is general agreement in the bubble and whole-body TLD results with the deviation of some individual results from linearity evident.

The results of Table 3 are presented in a scatter plot format in Figure 11. Figure 11 shows that there is general agreement in the bubble and whole-body TLD results with the deviation of some individual results from linearity evident.

Figure 11. Cumulative TLD Versus Bubble Dosimetry Results by Employee for the Entire Monitoring Period (1993 - 1996).

As reported earlier in this paper, the method of determining the NCF changed in late 1995 from a site-specific assigned factor to one calculated using the integrated reading on the supplemental Model 8823 dosimeter. The implementation of the supplemental Model 8823 dosimeter had the effect of lowering the average NCF. It was observed that following implementation of the Model 8823 NCF calculation method that the bubble dosimetry results tended to be significantly higher than the whole-body TLD neutron results. Table 4 shows the results comparing the

The result of using the Model 8823 dosimeter had the effect of increasing to 37% the average of the absolute values of the percent difference between the two measurement systems (Table 4, column 4) with the bubble dosimeters being higher 84 % of the time.

The resulting increased over-response of the bubble dosimetry relative to the TLD dosimetry since October 1995 using a more accurate measurement of the NCF is to be expected following analysis of the daily bubble dosimetry readings in Appendix B. Typically daily bubble dosimeter doses for employees in Appendix B were less than 20 mrem. As reported in Section 4.1, bubble dosimeters are expected to over-respond at low doses relative to their 20 mrem calibration. The data in Appendix B show that typical daily bubble dosimeter readings were usually in the region from 1 to 15 mrem where these dosimeters were shown to over-respond relative to the 20 mrem calibration value. The degree of over-response will be dependent both on the measured dose level and the sensitivity of the dosimeter used as indicated in Section 4.1.

6.0 Conclusions

This study has shown that the field use of the bubble dosimeters is an excellent ALARA tool that has been used at LANL to identify specific "high dose" processes and make immediate improvements and reductions in dose. Bubble dosimeters

Table 4. Cumulative TLD and Bubble Dosimetry Results by Employee Following the Implementation of Model 8823 Dosimeter (Oct. 1995 - May 1996).

	TLD	Bubble	Percent	
	Neutron	Neutron	Difference	
Individual	Dose (mrem)	Dose (mrem)	From TLD	NCF
EMP2	1087	1270	16.84	0.2
EMP4	542	1037	91.33	0.4, 0.5, ~0.2
EMP6	290	183	-36.90	0.4, 0.21
EMP8	892	1047	17.38	0.2
EMP9	489	731	49.49	0.19, 0.20, 0.5
EMP10	559	544	-2.68	0.19, ~0.20
EMP13	241	323	34.02	0.19, 0.20
EMP14	602	876	45.51	0.19, 0.22, 0.40
EMP16	1045	1068	2.20	0.2
EMP17	555	721	29.91	~0.25, 0.40
EMP18	452	810	79.20	0.19, ~0.21
EMP19	461	757	64.21	~0.24, 0.4
EMP20	942	1212	28.66	0.2
EMP21	303	168	-44.55	0.2
EMP26	354	635	79.38	~0.24
EMP27	867	933	7.61	0.2, 0.3
EMP30	797	967	21.33	0.19, ~0.21
EMP36	890	656	-26.29	~0.22
EMP40	231	310	34.20	0.2
EMP46	316	506	60.13	0.18, ~0.21
EMP47	435	499	14.71	0.19, ~0.21
EMP51	799	1077	34.79	0.19, ~0.20
EMP52	705	1004	42.41	0.2, 0.3
EMP54	805	952	18.26	0.2
EMP55	1040	1447	39.13	0.2
Total	15699	19733		
Average	628	789	28	
Variance	74029	114143	1160	
Std Deviation	272	338	34	

offer an excellent neutron energy response requiring no correction to the readings when calibrated with bare Cf-252 for neutron energies from about 200 keV to several MeV. Bubble dosimeters offer real-time feedback to the employee on the

magnitude of dose incurred in the workplace. However, limitations of bubble dosimeters have prevented more widespread use of these detectors for the dose-of-record in the United States. Some important limitations include: relatively narrow dose range, shock sensitivity, cost, longevity, and daily reading requirements.

Cumulative daily bubble dosimetry results for monitored employees in an operational environment were found to be within 37 percent of whole-body TLD results on average when using the new integrated NCF calculation. Further improvement in the agreement between bubble dosimetry results and TLD can be achieved by doing two things. First, by establishing a factor to correct for the deviation in relative sensitivity at low doses for bubble dosimeters or for calibrating the dosimeters closer to expected dose levels. Second, by ensuring that employees wear bubble dosimeters during the entire monitoring period where neutron exposure is possible and that they exchange the bubble dosimeters on a daily basis.

However, the limitations and inaccuracies on both dosimetry system types will always prevent an exact one-to-one correlation between the results of each system in an operational environment.

Albedo TLD does not offer the same advantageous energy response function as bubble dosimeters neither with the use of static Neutron Correction Factors nor with an integrated NCF dosimeter design. However, albedo dosimeters do offer the advantage of a stable, passive integrating device that does not have the other serious limitations associated with bubble dosimeters. For this reason, albedo

dosimeters continue to be used as the dose-of-record in the United States more often than bubble dosimeters.

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APPENDIX A: RELATIVE SENSITIVITIES VERSES NEUTRON DOSE FOR BUBBLE DOSIMETERS

The explanation for each column heading in this appendix is provided in the following key:

<u>column</u>	<u>explanation</u>
1	entry number
2	bubble dosimeter identification number
3	bubble dosimeter reader identification
4	reported factory calibration value
5	calibration value at LANL to 20 mrem bare Cf-252 (sensitivity reported in bubbles/mrem)
6	one standard deviation of standard value
7	percent coefficient of variation (100 times standard deviation divided by the mean)
8	sensitivity (bubbles/mrem) at 5 mrem bare Cf-252
9	sensitivity (bubbles/mrem) at 10 mrem bare Cf-252
10	sensitivity (bubbles/mrem) at 15 mrem bare Cf-252
11	sensitivity (bubbles/mrem) at 25 mrem bare Cf-252
12	5 mrem results normalized to 20 mrem value
13	10 mrem results normalized to 20 mrem value
14	15 mrem results normalized to 20 mrem value
15	25 mrem results normalized to 20 mrem value
16 - 27	repeat of column 2 - 15

Relative Sensitivity Verses Neutron Dose for Group 1

Bubble Dosimeters

Type: BD-100R, non-temperature compensated

Group#1, used routinely at TA-55 after initial calibration of 9/93

File I.D. Grp1

No.	I.D.	Reader	Fact Cal.	20mR				Exp.	5mR				Exp.	10mR				Exp.	15mR				Exp.	25mR			
				Sensi.	Sigma	COV(%)			Sensi.	Sigma	COV(%)			Sensi.	Sigma	COV(%)			Sensi.	Sigma	COV(%)			Sensi.	Sigma	COV(%)	
1	13487	TA-55	1.2	2.77	0.14	5.05		3.67	2.73	3.62	2.89	1.32	0.99	1.31	1.04												
2	14238	TA-55	1.2	3.72	0.13	3.49		0.00	4.17	0.00	0.00	0.00	1.12	0.00	0.00												
3	13171	TA-55	1.2	2.50	0.07	2.80		4.00	2.57	3.96	3.36	1.60	1.03	1.58	1.34												
4	15751	TA-55	1.2	2.62	0.18	6.87		3.73	2.43	3.18	2.96	1.42	0.93	1.21	1.13												
5	14845	TA-55	1.3	3.21	0.27	8.41		0.00	4.23	0.00	0.00	0.00	1.32	0.00	0.00												
6	14045	TA-55	2.0	4.89	0.22	4.50		6.87	6.73	6.42	5.99	1.40	1.38	1.31	1.22												
7	13329	TA-55	2.1	4.32	0.39	9.03		7.53	4.40	6.64	4.88	1.74	1.02	1.54	1.13												
8	14854	TA-55	2.2	4.93	0.19	3.85		6.20	3.97	6.93	5.29	1.26	0.81	1.41	1.07												
9	13464	TA-55	2.3	5.67	0.32	5.64		7.40	5.00	6.44	5.65	1.31	0.88	1.14	1.00												
10	14015	TA-55	2.4	5.08	0.18	3.54		7.93	7.07	6.51	5.88	1.56	1.39	1.28	1.16												
11	14261	TA-55	3.1	5.83	0.40	6.86		8.33	6.70	6.76	6.26	1.43	1.15	1.16	1.06												
12	14931	TA-55	3.1	6.60	0.26	3.94		12.73	8.63	8.91	7.69	1.93	1.31	1.35	1.17												
13	15007	TA-55	3.7	7.32	0.44	6.01		10.53	7.80	9.36	8.64	1.44	1.07	1.28	0.91												
14	14917	TA-55	3.8	7.07	0.37	5.23		10.93	8.13	7.84	7.56	1.55	1.15	1.11	1.07												
15	14912	TA-55	4.0	7.17	0.52	7.25		10.07	7.73	8.09	7.03	1.40	1.08	1.13	0.98												
16	13667	TA-55	5.3	8.80	0.18	2.05		15.73	10.70	11.31	8.41	1.79	1.22	1.29	0.96												
17	14491	TA-55	16.0	15.06	0.97	6.44		29.80	20.80	19.33	12.91	1.98	1.38	1.28	0.86												
18	14781	TA-55	17.0	15.93	0.90	5.65		32.13	21.63	18.87	13.16	2.02	1.36	1.18	0.83												
19	14816	TA-55	17.0	16.05	0.28	1.74		31.07	24.87	20.00	13.72	1.94	1.55	1.25	0.85												
20	14786	TA-55	17.0	15.72	0.56	3.56		0.00	22.57	0.00	0.00	0.00	1.44	0.00	0.00												
21	14796	TA-55	18.0	16.23	0.30	1.85		26.27	22.17	19.07	12.92	1.62	1.37	1.17	0.80												
22	16026	TA-55	19.0	16.56	0.23	1.39		0.00	24.27	0.00	0.00	0.00	1.47	0.00	0.00												
23	14457	TA-55	19.0	15.77	1.05	6.66		0.00	23.63	0.00	0.00	0.00	1.50	0.00	0.00												
24	14771	TA-55	19.0	16.20	0.44	2.72		0.00	23.43	0.00	0.00	0.00	1.45	0.00	0.00												
25	14764	TA-55	20.0	16.50	0.37	2.24		0.00	26.83	0.00	0.00	0.00	1.63	0.00	0.00												
26	15990	TA-55	20.0	14.86	0.73	4.91		0.00	22.57	0.00	0.00	0.00	1.52	0.00	0.00												
27	14815	TA-55	21.0	16.00	1.29	8.06		0.00	26.10	0.00	0.00	0.00	1.63	0.00	0.00												
28	16043	TA-55	22.0	17.18	1.23	7.16		35.13	24.43	20.11	12.72	2.04	1.42	1.17	0.74												
29	14500	TA-55	22.0	16.66	0.60	3.60		31.73	24.97	19.09	12.19	1.90	1.50	1.15	0.73												

	20mR				5mR	10mR	15mR	25mR				
	Exp.			Exp.	Exp.	Exp.	Exp.		5mR	10mR	15mR	25mR
Reader	Sensi.	Sigma	COV(%)	Sensi.	Sensi.	Sensi.	Sensi.	Norm.	Norm.	Norm.	Norm.	
SM-1898	3.01	0.39	12.96	3.53	3.20	4.09	3.09	1.17	1.06	1.36	1.03	
SM-1898	4.12	0.14	3.40	0.00	4.47	0.00	0.00	0.00	1.08	0.00	0.00	
SM-1898	2.85	0.57	20.00	4.13	2.90	4.00	3.31	1.45	1.02	1.40	1.16	
SM-1898	2.97	0.54	18.18	4.40	2.57	3.33	3.56	1.48	0.87	1.12	1.20	
SM-1898	3.57	0.70	19.61	0.00	3.77	0.00	0.00	0.00	1.06	0.00	0.00	
SM-1898	5.33	0.44	8.26	7.27	6.97	6.91	6.13	1.36	1.31	1.30	1.15	
SM-1898	5.16	0.80	15.50	7.87	4.70	7.49	5.77	1.53	0.91	1.45	1.12	
SM-1898	5.46	1.03	18.86	6.80	4.27	7.04	6.13	1.25	0.78	1.29	1.12	
SM-1898	6.25	0.30	4.80	8.13	5.27	6.98	6.21	1.30	0.84	1.12	0.99	
SM-1898	5.48	0.84	15.38	8.93	7.63	7.02	6.63	1.84	1.40	1.29	1.21	
SM-1898	6.92	0.72	10.40	8.87	8.43	7.58	6.96	1.28	1.22	1.10	1.01	
SM-1898	8.04	0.48	5.97	13.13	9.23	10.11	8.99	1.63	1.15	1.26	1.12	
SM-1898	8.07	0.71	8.80	11.67	8.53	10.80	7.75	1.45	1.06	1.34	0.96	
SM-1898	7.78	0.17	2.19	10.93	9.80	8.51	8.68	1.40	1.26	1.09	1.12	
SM-1898	8.14	0.59	7.25	10.40	8.67	9.24	8.39	1.28	1.07	1.14	1.03	
SM-1898	9.04	0.28	3.10	14.53	11.67	12.09	9.80	1.61	1.29	1.34	1.08	
SM-1898	17.81	0.94	5.28	32.00	25.13	23.76	17.77	1.80	1.41	1.33	1.00	
SM-1898	19.07	1.21	6.35	36.87	26.53	24.02	19.08	1.93	1.39	1.26	1.00	
SM-1898	21.69	0.95	4.38	35.20	31.00	27.04	19.19	1.62	1.43	1.25	0.88	
SM-1898	21.76	1.56	7.17	0.00	27.60	0.00	0.00	0.00	1.27	0.00	0.00	
SM-1898	20.60	0.92	4.47	28.87	26.70	25.93	19.28	1.40	1.30	1.26	0.94	
SM-1898	21.72	0.88	4.05	0.00	29.50	0.00	0.00	0.00	1.36	0.00	0.00	
SM-1898	20.58	0.71	3.45	0.00	28.87	0.00	0.00	0.00	1.40	0.00	0.00	
SM-1898	20.93	1.15	5.49	0.00	28.60	0.00	0.00	0.00	1.37	0.00	0.00	
SM-1898	22.53	1.84	8.17	0.00	31.77	0.00	0.00	0.00	1.41	0.00	0.00	
SM-1898	23.22	1.53	6.59	0.00	30.47	0.00	0.00	0.00	1.31	0.00	0.00	
SM-1898	22.64	1.45	6.40	0.00	33.03	0.00	0.00	0.00	1.46	0.00	0.00	
SM-1898	23.68	1.91	8.07	42.73	32.67	27.80	20.41	1.80	1.38	1.17	0.86	
SM-1898	21.47	1.64	7.64	39.93	29.47	27.58	18.93	1.86	1.37	1.28	0.88	

Relative Sensitivity Verses Neutron Dose for Group 2

Bubble Dosimeters

Type: BD-100R, non-temperature compensated

Group#2. used occasionally at TA-18 after initial calibration of 9/93

File:Grp2

20mR																20mR															
			Fact	Exp.			5mR	10mR	15mR	25mR									5mR	10mR	15mR	25mR									
No.	I.D.	Reader	Cal.	Sensl.	Sigma	COV(%)	Sensl.	Sensl.	Sensl.	Sensl.	Norm.	Norm.	Norm.	Norm.	Reader	Sensl.	Sigma	COV(%)	Sensl.	Sensl.	Sensl.	Sensl.	Norm.	Norm.	Norm.	Norm.					
30	14608	TA-55	1.2	3.23	0.28	8.67	1.93	3.83	3.53	3.24	0.60	1.19	1.09	1.00	SM-1898	3.16	0.08	2.53	2.47	3.43	3.78	3.48	0.78	1.09	1.20	1.10					
31	14619	TA-55	1.2	2.80	0.14	5.00	2.27	4.20	3.49	2.31	0.81	1.50	1.25	0.83	SM-1898	2.78	0.21	7.55	2.53	4.33	3.09	2.71	0.91	1.56	1.11	0.97					
32	13467	TA-55	1.3	2.92	0.23	7.88	2.67	2.67	3.11	2.75	0.91	0.91	1.07	0.94	SM-1898	2.60	0.54	20.77	2.20	2.80	3.18	2.83	0.85	1.08	1.22	1.09					
33	14264	TA-55	1.5	3.66	0.37	10.11	3.60	4.03	4.98	4.03	0.98	1.10	1.36	1.10	SM-1898	3.88	0.71	18.30	3.93	4.37	5.00	4.57	1.01	1.13	1.29	1.18					
34	14247	TA-55	1.6	3.70	0.29	7.84	4.27	3.67	4.22	3.79	1.15	0.99	1.14	1.02	SM-1898	4.21	0.27	6.41	5.27	3.77	4.71	4.24	1.25	0.90	1.12	1.01					
35	14292	TA-55	1.6	2.96	0.28	9.46	4.80	3.27	4.49	3.55	1.62	1.10	1.52	1.20	SM-1898	3.78	0.35	9.31	5.00	3.37	4.82	3.91	1.33	0.90	1.28	1.04					
36	14074	TA-55	1.8	3.70	0.19	5.14	5.73	3.77	4.76	4.03	1.55	1.02	1.29	1.09	SM-1898	3.99	0.88	22.06	5.33	3.93	4.60	4.40	1.34	0.98	1.15	1.10					
37	14989	TA-55	1.8	4.40	0.28	6.36	5.53	5.20	5.18	4.73	1.26	1.18	1.18	1.08	SM-1898	4.97	0.06	1.21	5.40	6.43	5.53	4.91	1.09	1.29	1.11	0.99					
38	14210	TA-55	1.9	4.30	0.26	6.05	5.33	4.80	4.53	5.03	1.24	1.12	1.05	1.17	SM-1898	4.80	0.40	8.33	5.87	5.53	5.00	5.40	1.22	1.15	1.04	1.13					
39	14969	TA-55	1.9	4.50	0.10	2.22	6.27	4.73	4.76	4.84	1.39	1.05	1.06	1.08	SM-1898	4.16	1.15	27.64	6.80	4.80	4.89	5.23	1.63	1.15	1.18	1.26					
40	14001	TA-55	1.9	5.42	0.43	7.93	4.07	5.77	7.11	5.05	0.75	1.06	1.31	0.93	SM-1898	5.59	0.48	8.59	4.20	6.00	7.67	5.65	0.75	1.07	1.37	1.01					
41	14037	TA-55	2.0	5.50	0.46	8.36	4.13	5.37	4.71	4.77	0.75	0.98	0.86	0.87	SM-1898	5.17	0.71	13.73	4.80	6.40	5.04	5.15	0.93	1.24	0.97	1.00					
42	14023	TA-55	2.0	4.92	0.11	2.24	4.47	5.63	6.07	5.64	0.91	1.14	1.23	1.15	SM-1898	6.12	0.54	8.82	4.73	6.07	6.04	6.00	0.77	0.99	0.99	0.98					
43	14054	TA-55	2.1	4.90	0.15	3.06	6.93	6.10	5.33	5.89	1.41	1.24	1.09	1.20	SM-1898	5.45	0.59	10.83	7.87	6.43	6.29	6.59	1.44	1.18	1.15	1.21					
44	14017	TA-55	2.1	4.98	0.46	9.24	7.73	4.93	5.53	5.13	1.55	0.99	1.11	1.03	SM-1898	5.29	0.36	6.81	9.27	5.33	5.78	6.27	1.75	1.01	1.09	1.19					
45	14175	TA-55	2.3	4.90	0.58	11.84	5.53	5.53	6.62	4.40	1.13	1.13	1.35	0.90	SM-1898	6.03	0.23	3.81	6.53	6.43	7.07	4.95	1.08	1.07	1.17	0.82					
46	14174	TA-55	2.4	5.79	0.41	7.08	7.27	6.07	7.29	5.97	1.26	1.05	1.28	1.03	SM-1898	7.35	0.29	3.95	8.67	6.47	8.02	7.00	1.18	0.88	1.09	0.95					
47	14437	TA-55	16.0	14.64	1.22	8.33	26.07	21.80	17.89	12.92	1.78	1.49	1.22	0.88	SM-1898	19.43	1.79	9.21	30.13	25.40	22.96	17.21	1.55	1.31	1.18	0.89					
48	14821	TA-55	17.0	15.90	1.12	7.04	31.33	23.67	17.49	14.33	1.97	1.49	1.10	0.90	SM-1898	20.00	0.74	3.70	38.73	29.93	22.31	19.41	1.94	1.50	1.12	0.97					
49	14784	TA-55	17.0	15.21	0.12	0.79	26.67	22.43	16.96	13.56	1.75	1.47	1.12	0.89	SM-1898	20.55	1.72	8.37	30.27	26.97	21.27	17.80	1.47	1.31	1.04	0.87					
50	14425	TA-55	18.0	16.58	0.40	2.41	33.13	24.07	18.09	12.93	2.00	1.45	1.09	0.78	SM-1898	21.80	1.63	7.48	35.40	26.97	22.49	19.61	1.62	1.24	1.03	0.90					
51	14791	TA-55	19.0	16.40	0.77	4.70	34.27	24.07	18.24	13.45	2.09	1.47	1.11	0.82	SM-1898	22.67	2.20	9.70	39.73	29.77	23.91	19.31	1.75	1.31	1.05	0.85					
52	14418	TA-55	19.0	15.80	0.46	2.91	29.73	23.57	18.27	14.16	1.88	1.49	1.16	0.90	SM-1898	21.93	0.14	0.64	29.73	27.43	22.82	18.21	1.36	1.25	1.04	0.83					
53	14814	TA-55	19.0	15.67	0.94	6.00	27.53	24.50	17.24	13.57	1.76	1.56	1.10	0.87	SM-1898	21.85	2.25	13.30	32.27	31.23	25.18	19.84	1.48	1.43	1.15	0.91					
54	14782	TA-55	19.0	16.40	0.13	0.79	25.20	22.70	17.49	14.16	1.54	1.36	1.07	0.86	SM-1898	22.61	1.87	8.27	29.80	27.97	21.84	19.88	1.32	1.24	0.97	0.88					
55	14443	TA-55	19.0	16.31	0.19	1.16	32.33	24.13	18.02	14.79	1.98	1.48	1.10	0.91	SM-1898	20.90	1.31	6.27	36.60	29.57	24.38	20.05	1.75	1.41	1.17	0.96					
56	14795	TA-55	19.0	17.23	0.80	4.64	28.60	26.30	17.84	14.92	1.66	1.53	1.04	0.87	SM-1898	21.86	1.64	7.50	31.07	30.10	22.62	20.04	1.42	1.38	1.03	0.92					
57	16203	TA-55	20.0	17.59	0.58	3.30	32.00	25.37	18.47	14.40	1.82	1.44	1.05	0.82	SM-1898	22.18	1.14	5.14	37.33	30.20	23.78	20.59	1.68	1.36	1.07	0.93					
58	14732	TA-55	20.0	15.34	0.18	1.17	29.13	22.13	17.71	13.85	1.90	1.44	1.15	0.90	SM-1898	21.42	1.32	6.16	31.73	27.60	23.38	18.32	1.48	1.29	1.09	0.86					
59	14777	TA-55	20.0	16.65	0.42	2.52	26.13	22.73	17.76	13.05	1.57	1.37	1.07	0.78	SM-1898	22.68	1.03	4.54	31.20	25.63	23.62	18.92	1.38	1.13	1.04	0.83					
60	14765	TA-55	20.0	17.19	0.11	0.64	30.40	23.40	18.44	15.32	1.77	1.36	1.07	0.89	SM-1898	23.11	1.94	8.39	33.67	28.43	23.58	20.17	1.46	1.23	1.02	0.87					
61	14828	TA-55	21.0	18.05	0.71	3.93	31.27	25.37	19.31	15.15	1.73	1.41	1.07	0.84	SM-1898	24.76	1.50	6.06	41.40	32.80	26.51	20.95	1.67	1.32	1.07	0.85					
62	16011	TA-55	21.0	17.16	0.23	1.34	31.80	24.27	18.09	13.72	1.85	1.41	1.05	0.80	SM-1898	22.45	1.16	5.17	33.47	28.60	22.73	18.35	1.49	1.27	1.01	0.82					
63	16214	TA-55	21.0	16.44	0.67	4.08	32.40	23.63	18.07	13.19	1.97	1.44	1.10	0.80	SM-1898	22.91	0.96	4.19	36.13	30.73	25.40	18.33	1.58	1.34	1.11	0.80					
64	14727	TA-55	21.0	16.30	1.22	7.48	31.47	24.63	17.24	13.35	1.93	1.51	1.06	0.82	SM-1898	23.34	2.62	11.23	35.40	30.73	24.38	19.61	1.52	1.32	1.04	0.84					
65	14775	TA-55	22.0	16.29	0.65	3.99	31.40	23.07	18.11	14.09	1.93	1.42	1.17	0.86	SM-1898	23.28	1.19	5.11	36.07	29.43	26.60	19.89	1.55	1.26	1.14	0.85					
66	16010	TA-55	22.0	16.41	0.23	1.40	31.93	23.57	17.36	12.97	1.95	1.44	1.06	0.79	SM-1898	22.49	1.52	6.76	38.00	29.37	23.91	19.48	1.69	1.31	1.06	0.87					

Relative Sensitivity Verses Neutron Dose for Group 3

Bubble Dosimeters

Type: BD-100R, non-temperature compensated

Group#3, never used in the field, except for calibration purposes after initial calibration of 9/93

File I.D. Grp3

20mR														20mR													
			Fact	Exp.			5mR	10mR	15mR	25mR					5mR	10mR	15mR	25mR					5mR	10mR	15mR	25mR	
No.	I.D.	Reader	Cal.	Sensi.	Sigma	COV(%)	Exp.	Exp.	Exp.	Exp.	5mR	10mR	15mR	25mR	Reader	Exp.	Sigma	COV(%)	Exp.	Exp.	Exp.	Exp.	5mR	10mR	15mR	25mR	
67	13497	TA-55	1.3	1.96	0.09	4.59	3.47	1.77	2.71	2.95	1.77	0.90	1.38	1.51	SM-1898	2.24	0.39	17.41	3.93	1.80	2.82	3.13	1.75	0.80	1.26	1.40	
68	14022	TA-55	1.5	4.58	0.14	3.06	3.13	4.60	4.38	5.25	0.88	1.00	0.96	1.15	SM-1898	4.28	0.43	10.05	4.07	4.67	4.49	5.73	0.95	1.09	1.05	1.34	
69	14914	TA-55	1.8	4.02	0.36	8.96	6.13	4.50	4.96	5.15	1.52	1.12	1.23	1.28	SM-1898	5.00	0.43	8.60	6.00	5.23	5.51	5.95	1.20	1.05	1.10	1.19	
70	14891	TA-55	1.8	4.04	0.36	8.91	5.07	4.97	4.60	4.32	1.25	1.23	1.14	1.07	SM-1898	3.67	0.42	11.44	5.60	5.03	4.67	4.79	1.53	1.37	1.27	1.31	
71	15115	TA-55	1.8	4.08	0.08	1.96	5.73	5.27	4.67	4.75	1.40	1.29	1.14	1.16	SM-1898	4.06	0.25	6.16	6.00	5.83	5.31	5.09	1.48	1.44	1.31	1.25	
72	14044	TA-55	1.8	4.56	0.25	5.48	5.93	6.93	5.80	5.08	1.30	1.52	1.27	1.11	SM-1898	4.34	1.05	24.19	6.87	7.50	6.71	5.61	1.58	1.73	1.55	1.29	
73	14964	TA-55	2.0	4.30	0.24	5.58	5.13	5.17	4.98	4.75	1.19	1.20	1.16	1.10	SM-1898	5.14	0.32	6.23	5.07	5.83	5.62	5.03	0.99	1.13	1.09	0.98	
74	14029	TA-55	2.1	5.33	0.32	6.00	6.07	6.03	6.02	5.67	1.14	1.13	1.13	1.06	SM-1898	4.94	0.84	12.96	7.13	6.97	6.60	5.88	1.44	1.41	1.34	1.19	
75	13930	TA-55	5.0	9.70	0.85	8.76	15.20	10.80	11.04	9.48	1.57	1.11	1.14	0.98	SM-1898	9.78	0.68	6.95	15.53	11.23	11.36	10.85	1.59	1.15	1.16	1.11	
76	15991	TA-55	17.0	15.60	0.23	1.47	29.07	25.43	18.09	12.08	1.86	1.63	1.16	0.77	SM-1898	20.98	1.21	5.77	33.53	30.53	25.78	18.89	1.60	1.46	1.23	0.90	
77	14419	TA-55	17.0	16.19	0.62	3.83	24.73	21.40	18.36	12.56	1.53	1.32	1.13	0.78	SM-1898	20.13	2.17	10.78	28.40	24.57	22.58	17.56	1.41	1.22	1.12	0.87	
78	14444	TA-55	17.0	15.48	0.49	3.17	32.73	24.17	17.87	12.11	2.11	1.58	1.14	0.78	SM-1898	21.07	1.87	8.88	36.80	29.90	23.22	18.65	1.75	1.42	1.10	0.89	
79	14810	TA-55	18.0	16.14	0.06	0.37	26.80	21.93	18.62	12.39	1.66	1.36	1.15	0.77	SM-1898	22.64	1.27	5.61	30.13	27.17	26.36	21.01	1.33	1.20	1.16	0.93	
80	16018	TA-55	19.0	15.78	0.76	4.82	27.47	24.67	19.18	11.51	1.74	1.58	1.22	0.73	SM-1898	21.28	1.54	7.24	30.87	29.73	24.53	18.19	1.45	1.40	1.15	0.85	
81	14787	TA-55	19.0	16.33	0.31	1.90	27.47	23.53	18.38	12.33	1.68	1.44	1.13	0.76	SM-1898	22.00	2.12	9.64	31.20	27.23	25.51	20.21	1.42	1.24	1.16	0.92	
82	12734	TA-55	21.0	14.60	0.03	0.21	32.07	23.17	15.78	12.39	2.20	1.59	1.08	0.85	SM-1898	21.05	1.84	8.74	32.93	27.57	22.69	16.44	1.56	1.31	1.08	0.78	
83	16105	TA-55	21.0	16.70	1.68	10.06	31.87	26.00	19.49	14.83	1.91	1.58	1.17	0.89	SM-1898	24.15	1.10	4.55	37.07	32.07	27.53	20.64	1.53	1.33	1.14	0.85	
84	14498	TA-55	21.0	15.47	0.77	4.98	28.13	23.17	20.76	13.17	1.82	1.50	1.34	0.85	SM-1898	21.60	2.61	12.08	30.93	28.13	26.53	19.12	1.43	1.30	1.23	0.89	
85	16271	TA-55	21.0	16.72	0.35	2.09	31.73	25.63	17.96	11.80	1.90	1.53	1.07	0.71	SM-1898	22.43	0.58	2.59	38.33	33.47	27.07	19.57	1.71	1.49	1.21	0.87	
86	14440	TA-55	21.0	14.91	0.30	2.01	28.80	23.70	18.38	12.00	1.93	1.59	1.23	0.80	SM-1898	20.83	0.89	4.27	30.13	28.03	25.07	19.19	1.45	1.35	1.20	0.92	
87	14716	TA-55	22.0	16.06	0.09	0.56	25.93	22.43	17.84	12.72	1.61	1.40	1.11	0.79	SM-1898	22.04	1.68	7.62	28.80	26.87	25.22	19.53	1.31	1.22	1.14	0.89	
88	16027	TA-55	22.0	16.24	0.48	2.96	31.93	24.17	19.53	12.51	1.97	1.49	1.20	0.77	SM-1898	22.92	1.35	5.89	38.60	29.53	26.13	20.15	1.68	1.29	1.14	0.88	
89	14499	TA-55	22.0	15.57	0.15	0.96	26.47	22.57	19.36	12.35	1.70	1.45	1.24	0.79	SM-1898	21.58	1.65	7.65	26.60	25.67	27.11	18.05	1.23	1.19	1.26	0.84	
90	14516	TA-55	22.0	16.78	0.42	2.50	28.87	23.20	17.93	12.47	1.72	1.38	1.07	0.74	SM-1898	22.01	1.84	8.36	31.60	29.07	23.87	19.89	1.44	1.32	1.08	0.90	
91	16248	TA-55	22.0	16.28	0.21	1.29	35.07	25.90	18.56	12.16	2.15	1.59	1.14	0.75	SM-1898	24.28	2.05	8.44	41.53	33.73	27.80	21.05	1.71	1.39	1.14	0.87	
92	14480	TA-55	22.0	15.75	0.32	2.03	29.93	23.37	18.80	12.51	1.90	1.48	1.19	0.79	SM-1898	23.16	1.90	8.20	34.93	28.63	27.62	20.43	1.51	1.24	1.19	0.88	

Relative Sensitivity Verses Neutron Dose for Group 4

Bubble Dosimeters

Type: BD-PND, temperature compensated

Group#4, initial calibration (20mR), 2/94

File I.D. Grp4

No.	I.D.	Reader	20mR				COV(%)	5mR	10mR	15mR	25mR	5mR	10mR	15mR	25mR
			Fact	Exp.	Sigma	Exp.		Exp.	Exp.	Exp.	Norm.	Norm.	Norm.	Norm.	
1	16372	TA-55	6.0	10.31	0.81	7.86	13.87	10.80	12.04	11.05	1.35	1.05	1.17	1.07	
2	13858	TA-55	6.0	10.21	0.28	2.55	13.87	13.90	12.69	10.29	1.36	1.36	1.24	1.01	
3	16418	TA-55	6.1	11.17	0.56	5.01	14.13	10.70	12.38	11.16	1.26	0.96	1.11	1.00	
4	16492	TA-55	6.2	10.92	0.52	4.76	10.67	12.17	12.24	10.33	0.98	1.11	1.12	0.95	
5	14314	TA-55	6.2	9.70	0.51	5.26	13.20	9.97	11.22	10.41	1.36	1.03	1.16	1.07	
6	14336	TA-55	6.3	10.03	0.72	7.18	12.07	9.37	11.29	10.49	1.20	0.93	1.13	1.05	
7	14319	TA-55	6.3	10.16	0.89	8.76	12.60	11.20	11.80	10.16	1.24	1.10	1.18	1.00	
8	16359	TA-55	6.3	10.82	0.82	7.58	13.20	12.90	13.27	10.72	1.22	1.19	1.23	0.99	
9	13918	TA-55	6.4	9.84	0.47	4.78	12.73	10.90	11.33	9.97	1.29	1.11	1.15	1.01	
10	16355	TA-55	6.5	11.06	0.57	5.15	11.27	12.63	11.84	11.63	1.02	1.14	1.05	1.05	
11	16400	TA-55	6.5	10.25	0.94	9.17	13.27	10.57	11.20	9.76	1.29	1.03	1.09	0.95	
12	16376	TA-55	6.7	10.96	1.04	9.49	13.47	13.37	13.87	10.28	1.23	1.22	1.27	0.94	
13	16441	TA-55	6.8	10.25	0.55	5.37	14.00	12.77	11.84	10.85	1.37	1.25	1.14	1.06	
14	16356	TA-55	6.8	12.25	1.61	13.14	15.93	14.67	12.53	11.43	1.30	1.20	1.02	0.93	
15	16333	TA-55	6.8	9.75	0.60	6.15	11.97	10.17	10.82	9.71	1.23	1.04	1.11	1.00	
16	16374	TA-55	6.9	10.67	0.44	4.12	13.80	12.20	10.96	10.41	1.29	1.14	1.03	0.98	
17	14345	TA-55	6.9	10.96	1.09	9.95	12.60	12.53	11.49	10.69	1.15	1.14	1.05	0.98	
18	16476	TA-55	7.1	10.91	0.39	3.57	13.33	9.80	11.67	10.28	1.22	0.90	1.07	0.94	
19	16455	TA-55	7.2	10.96	1.09	9.95	13.67	11.80	11.78	9.61	1.25	1.08	1.07	0.88	
20	16369	TA-55	7.3	11.24	0.57	5.07	15.07	12.73	12.98	10.23	1.34	1.13	1.15	0.91	
21	16370	TA-55	7.3	10.36	0.76	7.34	14.87	12.80	11.60	9.84	1.44	1.24	1.12	0.95	
22	16327	TA-55	7.5	11.03	0.31	2.81	12.27	12.13	11.96	10.72	1.11	1.10	1.08	0.97	
23	13860	TA-55	7.5	11.44	1.24	10.84	18.67	15.60	13.64	10.56	1.63	1.36	1.19	0.92	
24	16315	TA-55	7.6	9.94	0.76	7.65	13.80	12.17	13.07	10.17	1.39	1.22	1.31	1.02	
25	13884	TA-55	7.6	11.23	1.40	12.47	14.20	12.77	11.76	10.45	1.28	1.14	1.05	0.93	
26	13865	TA-55	7.8	10.98	0.51	4.64	17.33	13.73	13.42	10.59	1.58	1.25	1.22	0.96	
27	13836	TA-55	7.7	10.55	0.80	7.58	15.47	13.53	13.76	10.68	1.47	1.28	1.30	1.01	
28	13781	TA-55	7.8	11.86	0.84	7.08	20.20	12.47	13.20	11.35	1.70	1.05	1.11	0.96	
29	14339	TA-55	7.8	8.71	0.42	4.82	11.73	10.77	11.11	9.05	1.35	1.24	1.28	1.04	
30	14296	TA-55	7.9	11.55	0.76	6.58	13.93	12.87	13.00	11.76	1.21	1.11	1.13	1.02	
31	16433	TA-55	8.0	11.42	0.92	8.06	15.13	13.00	11.80	11.15	1.32	1.14	1.03	0.98	
32	14381	TA-55	8.0	11.25	0.50	4.44	18.07	14.27	14.64	11.24	1.61	1.27	1.30	1.00	
33	13893	TA-55	8.1	11.66	0.88	7.55	17.60	12.03	12.69	10.92	1.51	1.03	1.09	0.94	
34	13846	TA-55	8.3	12.08	1.19	9.85	17.07	16.00	14.56	11.57	1.41	1.32	1.21	0.96	
35	16496	TA-55	8.3	12.99	1.54	11.86	20.73	16.50	14.24	15.36	1.60	1.27	1.10	1.18	
36	14357	TA-55	8.4	11.59	0.43	3.71	16.40	14.40	13.82	11.72	1.42	1.24	1.19	1.01	
37	14342	TA-55	8.4	11.37	0.73	6.42	14.33	11.47	12.07	10.36	1.26	1.01	1.06	0.91	
38	13849	TA-55	8.6	10.84	0.37	3.41	12.93	12.33	11.60	11.53	1.19	1.14	1.07	1.06	
39	13925	TA-55	8.6	11.77	1.13	9.60	18.40	16.40	14.58	11.37	1.56	1.39	1.24	0.97	
40	16383	TA-55	8.7	12.13	1.18	9.73	17.87	13.27	14.47	11.69	1.47	1.09	1.19	0.96	
41	14331	TA-55	8.9	12.15	0.49	4.03	12.80	13.10	12.67	11.08	1.05	1.08	1.04	0.91	
42	13987	TA-55	9.6	10.31	0.20	1.94	14.47	14.77	13.60	10.44	1.40	1.43	1.32	1.01	

	20mR				5mR	10mR	15mR	25mR				
	Exp.				Exp.	Exp.	Exp.	Exp.	5mR	10mR	15mR	25mR
Reader	Sensi.	Sigma	COV(%)	Sensi.	Sensi.	Sensi.	Sensi.	Norm.	Norm.	Norm.	Norm.	Norm.
SM-1898	12.90	0.65	5.04	14.93	11.13	13.73	12.36	1.16	0.86	1.06	0.96	
SM-1898	13.19	1.52	11.52	14.87	15.37	14.87	12.48	1.13	1.17	1.13	0.95	
SM-1898	13.99	0.55	3.93	14.60	11.20	14.04	14.48	1.04	0.80	1.00	1.04	
SM-1898	13.79	1.42	10.30	11.80	14.03	13.73	12.35	0.86	1.02	1.00	0.90	
SM-1898	12.39	1.16	9.36	14.13	10.57	11.60	11.55	1.14	0.85	0.94	0.93	
SM-1898	12.18	0.54	4.43	12.80	11.37	12.07	12.83	1.05	0.93	0.99	1.05	
SM-1898	12.23	0.64	5.23	12.53	12.57	12.60	12.03	1.02	1.03	1.03	0.98	
SM-1898	13.21	1.11	8.40	12.87	13.53	14.58	12.88	0.97	1.02	1.10	0.98	
SM-1898	12.28	0.06	0.49	13.07	11.97	12.51	11.31	1.06	0.97	1.02	0.92	
SM-1898	13.75	1.06	7.71	11.27	14.57	13.09	14.04	0.82	1.06	0.95	1.02	
SM-1898	12.50	0.53	4.24	13.20	12.37	12.40	11.36	1.06	0.99	0.99	0.91	
SM-1898	13.80	1.11	8.04	14.00	14.63	15.47	12.12	1.01	1.06	1.12	0.88	
SM-1898	13.38	0.40	2.99	14.33	14.57	13.80	13.41	1.07	1.09	1.03	1.00	
SM-1898	16.08	1.62	10.07	16.53	16.93	14.13	14.67	1.03	1.05	0.88	0.91	
SM-1898	12.00	0.13	1.08	12.33	11.13	12.16	11.35	1.03	0.93	1.01	0.95	
SM-1898	13.42	0.57	4.25	13.40	12.63	12.29	12.29	1.00	0.94	0.92	0.92	
SM-1898	13.61	0.65	4.78	14.60	13.70	13.11	12.79	1.07	1.01	0.96	0.94	
SM-1898	13.10	0.25	1.91	14.27	10.87	12.53	11.36	1.09	0.83	0.96	0.87	
SM-1898	12.31	0.99	8.04	14.20	13.27	13.67	11.81	1.15	1.08	1.11	0.96	
SM-1898	14.49	0.54	3.73	15.67	14.57	14.93	11.69	1.08	1.01	1.03	0.81	
SM-1898	12.64	0.37	2.93	15.33	14.33	12.80	11.47	1.21	1.13	1.01	0.91	
SM-1898	13.99	0.85	6.08	12.40	13.37	12.98	12.49	0.89	0.96	0.93	0.89	
SM-1898	14.68	0.11	0.75	18.67	17.07	15.13	13.13	1.27	1.16	1.03	0.89	
SM-1898	12.48	0.76	6.09	14.47	13.33	14.22	12.33	1.16	1.07	1.14	0.99	
SM-1898	14.13	0.44	3.11	14.60	14.50	12.93	12.28	1.03	1.03	0.92	0.87	
SM-1898	13.92	0.51	3.66	17.60	15.13	15.33	14.37	1.28	1.09	1.10	1.03	
SM-1898	13.74	1.63	11.86	15.73	14.80	15.38	13.64	1.14	1.08	1.12	0.99	
SM-1898	15.53	0.06	0.39	22.60	13.53	15.33	14.52	1.46	0.87	0.99	0.93	
SM-1898	10.80	0.53	4.91	12.00	12.03	11.67	10.60	1.11	1.11	1.08	0.98	
SM-1898	14.60	0.22	1.51	14.00	13.47	16.02	14.27	0.96	0.92	1.10	0.98	
SM-1898	14.59	1.24	8.50	16.20	15.33	13.09	13.65	1.11	1.05	0.90	0.94	
SM-1898	14.10	1.11	7.87	18.20	15.63	16.78	14.51	1.29	1.11	1.19	1.03	
SM-1898	14.94	1.05	7.03	19.53	13.70	14.49	13.56	1.31	0.92	0.97	0.91	
SM-1898	15.33	0.19	1.24	17.93	17.30	16.22	15.44	1.17	1.13	1.06	1.01	
SM-1898	17.26	1.03	5.97	21.20	18.57	16.71	11.73	1.23	1.08	0.97	0.68	
SM-1898	14.68	0.73	4.97	19.80	15.60	15.93	15.35	1.35	1.06	1.09	1.05	
SM-1898	14.18	0.29	2.05	15.07	13.23	14.58	12.33	1.06	0.93	1.03	0.87	
SM-1898	14.20	1.33	9.37	14.93	13.30	13.22	13.37	1.05	0.94	0.93	0.94	
SM-1898	16.25	1.77	10.89	18.47	18.90	16.20	14.61	1.14	1.16	1.00	0.90	
SM-1898	15.14	0.66	4.36	19.00	15.33	15.73	14.93	1.25	1.01	1.04	0.99	
SM-1898	15.01	0.71	4.73	13.73	14.43	14.96	14.31	0.91	0.96	1.00	0.95	
SM-1898	13.22	1.40	10.59	14.87	15.77	15.20	13.56	1.12	1.19	1.15	1.03	

APPENDIX B: DAILY BUBBLE DOSIMETRY RESULTS FOR STUDY COHORT
(All Doses in mrem)

Bubble Dosimetry Results for 1993

May	3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28	31	Total	
EMP5							0	0.2	0.5		0	0	0.1	0.22	0.19		0	0.47					1.66
EMP12	1.16	1.79		2.47		0.92	1.4	0.9	0.6	0.33		0.5	0.5	0.89		2.69		0.43		0.49			15.01
EMP15							0.6	1.9	0.1	1.07		0.2	1.8	2.31	0.88	2.51	0.36	0.79		1.01			13.62
EMP22							0.1	0.4			1.11		0.9										2.52
EMP24		0.5			0.76	0.55	1.8	0.3	0.4		3.88	0.3	4.3	8.3									21.04
EMP25			0.7	0.75	1.49	1.43	2.2	0.3	2.8	1.11			0.5		0.28			0.44		0.89			12.86
EMP28														0.1	0.43	0.19	1.21						1.93
EMP30	4.97	0.44	2.66		1.78	4.38	1.6		1.5	0.76	0.71	2.6	0.9	2.03	1.5	1.42	0.43	0.89					28.58
EMP31	4.6	0.64		2.09							1.06	0.1	1.6			2.8				1.93			14.83
EMP33	0.92			0.97			2.2			9.07	3.6			8.96						6.88			32.57
EMP35	2.93	3.61	2.1			1.52	2.8	1.3	3.9		3.35	1.5	1.3			1.89	0.37	0					26.51
EMP37	0.38		0.2		0			0.5	0.73			0.7	0.2										2.7
EMP38	1.25			0.29			2.2	1.5				1	1.6				0.89						8.7
EMP41							2.1		1.6	0.44		0.7	3.3	1.31			0.31						9.73
EMP43	1.88	0.97	2	2.63	3.49	4.88	3	1.5	2.1	2.09	1.16	12	4.9	4.21		0.88							47.87
EMP45	0				3.68						1.7	0.3		0.25						1.35			7.31
EMP48										5.43	3.23	1											9.64
EMP52	3.37	2.89	2.88	0.57	2.67	1.35	4.7	2	1.1	1.41	2.07	2.5	2.6	1.3	0.79	5.94	1.45	0.78		3.44			43.8
EMP53					1.21			2.4		2.56				0.92				0.36					7.48
EMP56					1.97		4.6		5.2	0.1	1.97	2.5	4	1.38	1.22			0.47		6.94			30.44
EMP42	1.5	4.59	1.11	1.12	2.91	1.27	3.2	1.7	2.4	0.55	3.6	1.2	2.2	4.89	2.15	3.42	0.75	0.58					39.04
June	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	Total
EMP5	0.36	2.33	0.25	0.65	0.15		0.1		0.3														4.11
EMP15	3.03	2.22	1.57	0.97	5.37	2.88		1.5	0.9		2.28												20.77
EMP25									3.1		2.1												5.17
EMP28	0.44	0.86			0.21																		1.51
EMP30	1.53	4.98	8.65			4.88	4.8														14.55		39.42
EMP31			0.44	1.19		1.6	1.6		0	1.8	7.55												14.18
EMP33											2.11												2.11
EMP34				1.44		6			2.6														10.07
EMP35	1.94	0.41				1.41	2.7				4.97										6.23		17.68
EMP38	1.23					2.91	3.7			1.73	2.28												11.88
EMP41	3.78	2.14	3.4		2.44	3.49	1.2				0.96												17.45
EMP43				4.37		4.86	1.2				8.14												18.54
EMP45				0							4.17												4.17
EMP50						2.15					7.55												9.7
EMP52	2.04	2.58	1.86	0.9		9.25	4	2.9		11.9	4.28												39.69
EMP53								3.4															3.36
EMP56			0.48							9.29	2.75											18.69	31.21
EMP42														10.2									10.23

Bubble Dosimetry Results for 1993

July		1	2		5	6	7	8	9		12	13	14	15	16		19	20	21	22	23		26	27	28	29	30	Total
EMP5														0.3														0.27
EMP7																			4.21	1.78	1.57			2.4		4.87	6.02	20.84
EMP12								1.47											5.74	5.16			3.41		5.21	4.89	2.02	27.9
EMP24								7.26																				7.26
EMP25																			1.59	1.03							2.27	4.89
EMP28								0.9			0.13			0.5								2.42	0.53	0.2				4.6
EMP30																						5.43					5.85	11.28
EMP31											1.35							3.5	2.62	1.03	2.06		2.42	5.7	3.78	6.81	1.65	30.94
EMP33																		8.01					10			4.75		22.78
EMP34								0.59	0.6					0.8								0.39					1.52	3.85
EMP37								0.64																			0.55	1.19
EMP38											3.37	2.66	0.91						1.37					2.9	1.63	1.96	2.13	17.14
EMP41																			5.98	5.86			3.85		2.98		6.02	24.69
EMP43								18.9	1.5		4.19	5.2								1.91					13.7	3.68	49.08	
EMP45											4.74						0.37		1.61	0.51							2	9.23
EMP48																							2.1					2.08
EMP50																								5.16	2.02	1.17	8.35	
EMP52								9.81	1.5			2.19		1.5	0.4		2.74	1.83		2.43				1.99		2.95	27.27	
EMP56									12		13.7	4.26		1.6					8.04	2.53							3.6	45.93
EMP42								3.16																			2.64	5.8
August		2	3	4	5	6		9	10	11	12	13		16	17	18	19	20		23	24	25	26	27		30	31	Total
EMP7		2.05	4.46	2.68	5.11	2.56			8.3	2.6	3.4	5.65		9	8.2	3.9		0.95		1.11	1.78		1.1	2.36		3.77	3.39	72.31
EMP10						9.53						13				15							2.1					39.33
EMP11					4.29									1.38														5.67
EMP12		2.37	2.81	1.36	4.24	1.18			5.8		1.3	2.44		5.32	4.4	0.5				0.6	1.78	1.1	0.9	2.77		1.56	0.68	41.18
EMP25					1.67			0.92				2.79				1.3						1.72		0.29				8.71
EMP28						0.24			1.2	0.3	0.1	0.83			0.3	0		0.46			0.13					0.99	4.55	
EMP30					6.27	1.77						2.22				7.5		4.94			3.31		7	1.37		5.32	39.71	
EMP31		0.48	3.89	1.71	3.88			1.24	2.1																	3.92	17.22	
EMP33						12			8.8		6.8											10.4			7.46	0.63	45.98	
EMP34				0.76					0.1			1.17			0.9			2.45			2.82		1.35				9.57	
EMP35				1.45		3.66			3.9	2.4	1.3	3.44			5.1		4.14	2.15			2.18	2.14	0.7		2.66		35.25	
EMP37												3.12			2								1.49			2.52	9.1	
EMP38			0.92						0.8	1.3	0.5				1.8	4.2	0.25			0.5	1.1	4.42	2			3.47	21.29	
EMP41				5.09		8.46					4.5	3.87				14				4.18						6.34	46.05	
EMP43		3.54	0.92						3.6		2				12	1.2				0.99							24.39	
EMP45					2.55	1.81						5.45		3.72	4	0.5									3.48	10.1	31.6	
EMP48											3.5	2.13								1.7							7.3	
EMP50		2.27			2.65			0.74	12	2.9	3			10.3	14								4.65				52.68	
EMP52		2.96	2.48		2.81	0.45														1.63	0.78		1.46		1.8	4.4	18.77	
EMP53			0.65									6.5		6.5						3.16							16.81	
EMP56		2.53		1.65							2.2				8					8.55	5.85	3.5	1.03		7.69	3.33	44.36	
EMP42			2.89		4.13	2.32			5	3.3		5.28			7.9		3.56								1.15	0.65		36.21

Bubble Dosimetry Results for 1993

September	1	2	3	6	7	8	9	10	13	14	15	16	17	20	21	22	23	24	27	28	29	30	Total
EMP5																			0.45	0.5	0.24		1.18
EMP7	5.41														4.69	0.53		4.88	1.52	5	6.42	3.38	31.84
EMP10		10.5																12					22.56
EMP12		0.75												1.03		0.32	0.8	4.78		0.4	2.01	2.89	13.02
EMP25		1.19				1.14	0								1.17	1.07	1.5	0.67	1.07	1.2	1.39		10.41
EMP28																	0.39	0.55		0.12	0.3	0.13	0.98
EMP30	2.09												1.6										2.43
EMP31	3.76					0.74								1.1	0.9					1	7.11	4.76	3.7
EMP33	4.65																						19.41
EMP34		1.13															3.86						11.35
EMP35	2.11														0.68		7.91	1.19	0.9	2.2	2.69	0	16.72
EMP37														1.26	1.45	1.48	1.95						8.25
EMP38	2.83																3.76		0.59	0.3	3.15		7.81
EMP41						7.99							1.6		2.86	1.3	1.18	0.46					10.21
EMP43															1.27			7.47	3.31	3.3	2.47	2.97	27.5
EMP45																		0.69		0.5			2.43
EMP48														1.2	0.44	1.17	2.8	2.37					7.98
EMP50																		4.2			3.96		8.16
EMP52	7.45					0	0.65							8.66		1.97			2.76	0.5	0.74		14.58
EMP56	3.1																						8.1
EMP42						1.32				2.98	2.05	3.1	1		1.1	2.54	0.86	5.15	4.01	3.6	4.1		19.96
																		0.26	4.52	0.48	0.8	1.07	22
October	1	4	5	6	7	8	11	12	13	14	15	18	19	20	21	22	25	26	27	28	29	Total	
EMP5		4.66																				4.66	
EMP7			0.65	0.73	1.5	1.2																4.08	
EMP10	4.52		1.19	0.72					1.81	5.69	4.3		1.3	1.76				0.8	2.8			24.88	
EMP11															0.32							0.32	
EMP12	0.96	1.49		1.97				1	1.84	4.7												11.91	
EMP18																		7.43	0.2		6.3	13.88	
EMP22			6.74																			9.27	
EMP25		0.26	0.31	1.72	0.89	0.16		0.4	0.65	0.36	0.28									0.1	2.53	6.09	
EMP28		0		0.16	0.53	0.36		0	0.23	0.88		0.2		0.52								2.91	
EMP30	1.45	2.42		2.87					1.41	0.86	2.65		4	2.22		9.4		2.3				29.52	
EMP31	1.44	3.76	0.08	0.99	0.64	1.55		1.1	0.87	0.23	2.39						3.23	0.6	0.65	7.1	9.27	33.86	
EMP33	1.21	3.4	4.33						5.39	5.14	4.61		3.18	2.93		1.58		0.95	0			32.72	
EMP34	0.47									5.73			0.3	2.32	2.47	0.61	1.12		0.77	0	1	1.22	16.03
EMP37	2.02	1.99	3.14	1.85				1.2		1.18					1.37						0.5	1.02	14.22
EMP38								3.5	13.8	3.3	1.02	2.8		3.67		3.02	15.1	0.5	0.66	3.5	0.51	51.34	
EMP41	2.24	6.18		2.04					2.4	6.99	3.01	3.5		9.17			2.81		2.38	4.7		45.34	
EMP43		0.44																				0.44	
EMP45													2	20.7	13.3	12.5		0.96				49.48	
EMP48	7.59	5.94	3.37	3.69		2.6							1.2	1.88	3.39							29.62	
EMP50	1.76	2.79	7.47	2.17	1.7	1.69		2.8	4	1.65	5.5	6.6	11.8	1.79	0.77	0.85	5.75	0.2			0.98	60.16	
EMP52																			0.7		10	11.15	
EMP53								1.5														1.49	
EMP56	2.25	3.64	1.77	3.25	1.38	2.36		5.5	5.03	1.46	0.43											30.84	
EMP42	1.99	2.4	1.54	1.11	1.04	0.89		1.9	2.28	2.7	1.58		2.2	2.43	2	1.16					3.75	25.23	

Bubble Dosimetry Results for 1993

November	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	30	Total
EMP3						0.24	5.5				2.47	6.7	4.3	5.1	6.17	6.24	2				1.75	1.65	42.13
EMP7	1.75	1.52	1.49	10.3		4.22	3.4	0.7			1.79	2.2	3.3	2.03	2.64	1.13	0.51				0.18	1.1	38.3
EMP10	2.76			3.28	0.44	0.37	2.2				0.77	2.8	4.9		2.02	2.14		2.08				0.35	24.09
EMP12	0.99	1.3	0.55				0.8					0.8	0.5		0	1.6							6.54
EMP18	5.98		0.88		4.73	1.08	0.7	3.2		0.85	4.83		3	6.58	5.58						2.01	0.67	40.1
EMP22							10																10.12
EMP25	0.32	1.28	0.73		0.95		1.4	0.1		0.87	1.03	0.3	0.4	1.32	0.27		0.58				1.99		11.59
EMP28	0	1.13					0.4	0.1			0		0.3	6.85	3.43	0.66							12.97
EMP30					1.69		7.5			3.5						9.12	3.9				4.88		30.63
EMP31	3.82	6.86	1.41	5.48	3.33	1.89	9.8	1.5		0.72	0.3	6.3	2.1	4.15	4.29	2.49							54.44
EMP33						1.2	2.6			0.45		7.6	2.5	1.35		2.88							18.58
EMP34			0.17	0.84	0		0.9				0.92	1.5	1.7		0.24	0.61	0.93	0.3			0.32	0.98	9.38
EMP35	1.03	0.55																					1.58
EMP37	4.14	0.82	0.62	1.58	0.61	0.71	2.3	0.9								0.62					1.19	0.5	13.89
EMP38	3.72						1.1					1.9		1.28	4.99		4.31	0.42				1.36	19.07
EMP41					0.77		1.5				1.6	1.2		5.22	2.73	3.7	4.15					2.73	23.57
EMP43		2.01	12.5								1.73	11			5.68	11.8	11.5	2.35			0.67		59.03
EMP45							1.9																1.87
EMP48							0.5			5.17	2.49	5.5	1.7	1.41	1.51	0.99	1.19				0.34		20.82
EMP50	1.76	2.63	0.53	6.45	1.79				2.36		3.7	7.8	8.24	3.06		3.98	1.72	0.57			6.04	2	52.66
EMP52	9.71	7.57	2.28	2.9	7.8		4.6	5.1	5.05	9.48	5.6		4.95	4.27		4.48	1.53	0.91			3.25		79.48
EMP53			0.63									0.7		1.47	5.59								8.36
EMP56	4.12	4.11	7.48	2.25	3.45	4.43		9.6	2.35	6.07	7.1	8	0.2	3.01		8.71	14.4				1.21		86.53
EMP42	3.03	2.2	2.07	6.65	1.2	2.37	3.4		1.09	1.63	0.9	2.8		0.52		1.6	1.45	0.73			2.28		33.87
December	1	2	3	6	7	8	9	10	13	14	15	16	17	20	21	22	23						Total
EMP3	6.41	12.9				13.8	5.07	4.9	7.6	16.3	1.67	6.36	3.3	3.6		4.79	1.97	0.33					88.92
EMP7	0.48	0.43	0.39		2.66	1.23	2.85	0.4	2.9	2.36	1.74	1.07	1.3	1	0	2.18							20.98
EMP10							0	4.7	1.1	18.7	1.23		7.8			5.21							38.75
EMP11																0.1							0.1
EMP12	1.02	0.97			2.85	0.31	2.8		0.6	3.45	2.05	6.31	0.7			1.27		1.86					24.2
EMP18	4.7	1.63	1.1	3.16	6.68	3.71	2.7	2.7		3.74	8.18	5.25	2.2	2.1		2.91	0.4	1.16	0.43				52.74
EMP25	0.63	1.95	0.29		0.96		0.2	1.3		0.7	0.82												6.85
EMP28		0.39			0.12	0	0	0															0.51
EMP30	5.73	1.48	0.72	1.93	5.47	6.51	2.2	4.3		5.58	7.55	3.93	1	0.3		0.6	1.05						48.26
EMP31	1.24	2.52	13.1	3.1	9.37	2.17	12	3.2		14.3	5.72	0.75	1.1	2.4		0.32	10.4	1.29					83.28
EMP33	1.03	8.48			3.56					12.4	5.68	3.43						2.24					36.82
EMP34	1.28	1.1	0.15	0.35	1.21	1.12	3.3			1.19	0.58	0.8	0.5			0.42		0.24					12.19
EMP37	0.91	0.92		2.12	3.2	1.92	1.8	2.1		4.8	0.6					1.3	5.1						24.77
EMP38		2.21			2.82	3.69				8.05	3.14	2.9				1.02							23.8
EMP41	2.84	4.91	1.81		2.1	7.96	3.28	1.6		5.92		2.2				1.51	2.78						36.97
EMP43				0.51	6.16																		6.67
EMP45									1.97														1.97
EMP48	1.52	0.82		1.25		2.81	2.9	2.5		8.8	0.9	2.4											23.89
EMP50	9.45	14.5	7.02	5.97	17.3	6.07	3.7	8.8		15.4	5.1		1.1		1.05	6.26							101.6
EMP52	1.24	0.3		9.63	8.19	2.76		2.1		6.16		2.5	5	2.4		3.94	1.77	0.64	0.54				47.16
EMP53										2.92	6.08	5.41	1.8										16.18
EMP56	0.79	1.16		0.18	13.1	2.01	0	0.4		5.15	11.2	2.5	5.7	5.3		3	1.34						51.85
EMP42	1.25	0.53	1.72		0.2	8.9	3.83	2.5	1.5	6.14	8.64	0.95	0.2	0.7		6.18	2.11	0.36					45.67

Bubble Dosimetry Results for 1994

January	3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28	31	Total
EMP3	1.23	0.53	3.55	10.20	10.45	2.16		0.74	0.57	8.85		20.13		7.87		4.18	6.44		3.57		5.62	86.1
EMP10				6.42	9.24	0.10	10.93	3.14				14.19				0.66			2.93			47.8
EMP33			1.98	0.71		5.13		10.26		1.48		11.92		8.25		1.87	2.64		2.77			47.0
EMP48			0.38									23.73	2.00	6.55	0.73	3.88	4.33		3.85		5.71	50.9
EMP50		1.06	1.38	8.58	4.91	1.06	17.40	9.18	2.87	1.34		12.92	7.84	9.49		1.99		3.01	4.48	10.71		96.0
EMP18	1.46	11.84	1.27	2.33	1.80	3.24	1.63	4.27	1.93	4.77		7.86	0.99	2.59	1.26	2.18		0.56	1.50	0.56	1.40	52.8
EMP30	1.28	8.48	0.66	4.80	1.32	3.41		1.38	6.58	6.58		6.61	1.81	2.24	4.44	0.28	1.00		1.38		0.73	53.2
EMP52	0.39	5.88	1.38	3.26	2.36	3.84	4.13	4.13	2.46	5.3		8.57			4.48	1.83	1.15		1.72			48.5
EMP7	1.18	0.23	0.28																			1.7
EMP11	0.48	0.18		2.74		2.73				0.49		2.54										9.2
EMP12	0.45	0.99	1.11			1.21	8.48	1.29		0.42		1.81		2.94		0.84			0.19			19.7
EMP34	1.02	0	2.69	0	0.8		1.47	1.55	0.49	0.53		0.75		0.78							0.82	10.9
EMP56	0.74	5.33	0.98	3.21			0.56	3.52		12.1		7.81		1.88	4.25	0.86			0			40.6
EMP31		0.51		1.54	0.71	1.5	12.63	5.58		1.79		1.44		1.08	1.12		0				1.05	29.0
EMP38		2		3.94			5.21	4.58				3.74					0.78	0.19				20.4
EMP37			0	0		0.88		1.85		2.25		1.01										6.0
EMP41			2.87	1.26	1.21	1.6	1.88	1.92	3.17							2.05		1.74		1.08	1.46	20.2
EMP28							0	0	0	0.48										0.04		0.5
EMP13																					0.88	0.9
February	1	2	3	4		7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	Total
EMP3				8.92	1.01	4.14		5.41		10.18	8.83	8.48	8.00	7.84	6.12		6.07	7.48	9.95	13.99	3.19	107.6
EMP10	10.82				0.85		5.04		6.54	6.19	5.79	7.19	6.94	6.34	6.79		7.87			21.23		91.4
EMP33	5.05	4.09	10.00	1.03		3.72	2.61	3.19		7.05	9.86	8.25	6.54	5.73	2.81		7.82	3.48	4.31	9.23	9.23	104.0
EMP48	5.00	4.53	9.83	1.82		4.43	2.71	8.83			8.13	7.19	8.09	10.88	1.79		7.04	3.90	5.23	4.93	5.49	97.7
EMP50	4.29	3.90	4.85			0.25	2.58	4.89	4.84	5.58	10.98	7.83	3.82	11.80			7.24	14.33	6.84	7.75	12.09	113.2
EMP18	5.98	1.11	1.79	3.13		0.88	2.90	4.14	5.46	1.44	1.56	13.28						2.50	5.21	4.06	1.03	54.3
EMP30	8.68	1.27	2.01	2.97		1.36	3.82	5.00	5.78	0.40	0.92	8.98	2.88	4.21	4.05			3.58	3.56		1.26	60.7
EMP52	5.40		6.38	1.14		3.03	3.19	1.90	4.87	0.78	2.39	7.56	2.87	16.81	6.23		3.36	1.61	5.13	5.08	1.67	79.2
EMP13				1.64		1.55	2.06	2.98	5.48	6.59	4.09	3.40	4.88	2.12	3.47		0.08	3.05	1.77	3.95	1.79	48.9
EMP12	0.77	1.44	0.8	0.48			2.52		3.4	2.98	1.79	4.57	2.13	6.22	1.86		1.09		3.64	4.52		36.2
EMP28	0.26			0.34			0.26			0.82	0.27							0.96	0.37	0.58		3.9
EMP38	1.72						1.23						2.08									5.0
EMP56	3.41		1.45	1.14			1.53	4.02		0.29	0.86	2.13	2.27				6.1		4.74		1.32	29.3
EMP37		0.07		3.11				1.44	2.55		2.38			0.63	0.68		0.52	0.81	2.02		0.9	15.1
EMP41		4.20	1.29	1.05			2.22	2.36		3.80	3.33	1.78	3.75	1.48			1.69	2.63	1.23	2.09	0.95	33.7
EMP31			1.11	0.24		1.49			1.8	2.63	0.78	5.8	0.71		1.90			0.20				16.2
EMP34						1		0.78	1.18	0.55	0.45	0.98	0.46	0.24			0.63	0.30		0.07	0.26	6.9
EMP1																		3.83			2.59	6.4
EMP20																		5.25	3.61			8.9

Bubble Dosimetry Results for 1994

March	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	31	Total
EMP3	8.37	9.52	4.04	3.03	2.96	1.04			4.04	0.85	4.80	9.32	9.95	11.52	7.88	11.94	1.24	6.47	7.53	3.95	1.03	9.08		118.1
EMP10	11.83		5.75	4.81	0.88			7.03	2.94	5.79	10.41	0.96		11.58	7.20	15.14	1.58	11.20				7.57		104.7
EMP33	7.11	6.88	4.91	4.44	4.23		3.18	2.25	3.28		9.18	8.81		4.08	8.62	10.00		8.20			6.90			92.3
EMP48	5.88	7.70	4.08	1.85	1.90	6.08			6.89	0.58	5.08	5.38	6.38		10.47	6.23		6.78			4.88	9.80	5.77	97.7
EMP50	5.43	10.88	4.47	7.16	3.18	4.05		3.18	0.90	8.83	9.51	5.15	0.49	4.44		6.50		8.01			4.48			86.8
EMP1	2.07	0.08	0.35	0.21	1.59			4.54		0.93	7.84	11.09	6.29	0.58	2.85	1.03	0.32	0.91	1.98	2.68	3.12	2.15	3.89	56.1
EMP18	1.32	1.62	1.33	1.13	1.81	4.80	2.51	4.47	1.11	2.05	1.37	3.93	5.08	1.85	2.37	3.89	1.73	7.01	1.93	11.59		3.42	6.27	72.4
EMP30					1.42	3.80		5.33		2.57	1.01	2.13	4.07		4.14	0.89				3.25	5.39		1.46	35.5
EMP52	1.22	1.20	0.89	0.57	0.71	3.08	2.51	0.85	0.58	1.02	1.89	0.90	0.99	1.35	4.22	2.35	1.50		1.90		5.09	0.17		32.8
EMP37					5.50	4.50			4.18			6.52	6.33		3.88						5.05	8.28	4.55	48.8
EMP13	1.24	1.53		1.84	3.14	2.68		3.88			3.80	1.79			3.98	9.85	0.53	6.56	4.44	22.29	4.11	0.96	2.81	75.0
EMP1	2.07	0.08	0.35	0.21	1.59			4.54		0.93	7.84	11.09	6.29	0.58	2.85	1.03	0.32	0.91	1.98	2.68	3.12	2.15		52.4
EMP12	1.78	1.4	1.99	1.16	3.55			1.18			2.52	0.85	2.22	4.43							3.96	3.55	1.57	30.2
EMP28	0.07	0.99							0.88															1.7
EMP38	0.84					2.89					2.92							3.77			0.29			10.5
EMP56	0.91	1	0.39	0.29	1.09	5.62		3.81	0.35		3.51	1.03	1.13		2.41	1.08		1.31						23.7
EMP20		0.44																						0.4
EMP41		2.14	1.71	1.67	4					5.18	2.42	1.12	3.19	1.83	8.46			2.33	6.38			0.59		41.1
EMP34			0.45	0.28					0.5	0.44	2.18	2.53	4.85	0.4	0.18	2.48	0.88	2.96	0.98			2.11	1.82	22.6
April	1		4	5	6	7	8		11	12	13		18	19										Total
EMP3			4.49	1.51	0.93	1.62	0.98		2.93	3.58														18.22
EMP10	3.09		4.38				1.25		1.41															10.13
EMP33	8.15								4.27															12.42
EMP48			3.88	0.37				2.22	2.88	3.81														12.94
EMP50			9.2		0.84		0.47	1.12	1.81															13.44
EMP1			2.17	6.92	0.23	2.69	0.8		2.05	0.83														15.79
EMP18	2.73			14.74	3.55	3.74	0.89		3.33															26.96
EMP30			1.55	12.07	1.44	1.59		3.79	5.08															25.9
EMP52	2.92		2.23	1.28		0.48	0.94	9.48	4.13															21.48
EMP37			3.07	0.92	8.84	4.95	3.31		5.8	4.14														29.03
EMP13	0.59		2.54	10.2	4.71	1.62	1.34	1.23	5.46	0.71														28.42
EMP12	4.12		0.77		2.08	3.14	1.87																	11.78
EMP34	0.37		0.93	4.95	2.23	0.44	0.47	3.19	2.22	0.41														15.21
EMP56			0.23	11.71				3.18																15.1
EMP38				7.62					0.98															8.58
EMP41			4.94			1.32		0.49	28.62															35.37
EMP51						0.79			5.98	0.8														7.35
EMP28								0.5																0.5
EMP20								2.27																2.27
EMP46																								0

Bubble Dosimetry Results for 1994

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Bubble Dosimetry Results for 1994

July	1	4	5	6	7	8		11	12	13	14	15		18	19	20	21	22		25	26	27	28	29				Total
EMP2															5.38	1.52				2.11	0.3	4.48	4.26	1.64				19.69
EMP33						9.56		5.25	9.68	3.24	5.03				6.47						7.21	4.34	6.61	1.35				56.7
EMP48					2.43				5.10	2.33	5.06			4.82	10.31	4.97	5.94	4.70		4.09	1.75	3.73	6.02	1.64				62.9
EMP18			3.63		4.01	3.27		0.96	5.13			0.74		4.73	5.56	6.02	6.61	2.37		5.60	12.26	7.64	4.78	2.21				75.6
EMP26				1.70				3.19	0.68		1.43	2.63		4.82	7.62	4.70	6.73	3.59		6.12	11.26	4.26	5.31	2.93				66.6
EMP41										3.14				1.41	6.94	8.37					0.49							20.4
EMP47			0.70						2.30	2.47				2.28	6.94	18.10		3.33			1.01	0.55	1.11	0.24				39.0
EMP20			3.03					5.26	1.69	4.4	1			6.9	7.09	4.32	4.46	2.05		5.53		0.92	4.02	0.56				51.2
EMP1			2.36		1.67			0.36	3.7	0.95	2.35	2.19		2.03			0.52				5.41							21.5
EMP3			1.33																									1.3
EMP10			2.46		3.93			0.69						5.71	15.63	5.65		4.21			5.52	2.76		3.33				50.3
EMP38			0.31		0.73				2.41	3.68	4.06	1.13			8.15	4.4		16.55			5.91	6.74	0.23	0				54.3
EMP13			2.93		1.63	1.66		4.74	2.36	3.27	4.15	2.74			10.96	5.79	2.84	8.31		1.31	2.71	1.99	0.82	1.33				56.6
EMP62				2.76	4.74	1.23		1.03	0.99		2.73							0.35		5.17		3.01	1.02	1.21				24.2
EMP61					4.97			1.66	0.61	0.92	1.02	1.46		6.67	6.91	1.05	2.67	3.95		2.72		3.54	2.69	1.83				43.3
EMP66					4.9			3.7	1.61		4.29	5.78		4.65	5.95	2.91	1.28			0.1	0.61							36.1
EMP30								3.6		1.19	2.36	4.8		3.93	6.23	3.24	1.66	2.1										31.3
EMP34								3.27	1.91	4.44	1.41			0.31			1.17	6.21		0.52	4.51	8.45	0.09	0				32.3
EMP60									4.22																			4.2
EMP37											0.6	0.74		2.31	2.26	1.52												7.5
EMP31											6.64																	6.6
EMP36														2.17	9.06	3.56	1.55	2.62		6.08	2.31	4.25	6.52	1.33				39.5
EMP23														0.43														0.4
EMP49														0.25														0.3
EMP21															9.22		7.48	3.26		2.46	0.71	1.67						24.6
EMP40															7.1	2.85	3.82	4.46		1.67	0.53	3.53	3.27	2.96				30.2
EMP28																			13.76		10.89	2.02	2.77					29.4
EMP12																				2.05								2.1
EMP27																				2.09	0.55	1.56	3.05	2.06				9.3

Bubble Dosimetry Results for 1994

August	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
EMP1															3.08	2.59																5.67
EMP2	2.30							0.34	7.39	6.74	6.42	2.93			1.75	7.97	0.26	3.47	1.52			4.29	7.46	3.25	3.65	6.78			5.80	9.38	5.71	87.6
EMP10	0.28	1.73								9.21	3.40	5.36					2.57	1.04				4.44	4.03	7.21						9.78		49.0
EMP21	2.42	1.76	5.79	2.26	0.72			0.81	7.92	6.62	6.30	0			4.12	4.88	0.19	2.95				0.69			3.15	9.00		9.22	6.66	6.44		85.9
EMP27	3.82	3.07	6.33	2.13	0.91			0.66	6.42	7.40	3.89	3.79			4.57	12.74	0.39	1.94	2.13			4.31	5.08	6.04	5.42			4.16	7.25	6.18		96.9
EMP33	2.54	1.00	2.46	2.35	2.35			3.56	2.75	6.16	2.01	5.24										1.27	3.40	3.78	5.14	2.69		9.66	3.43	6.11		67.9
EMP36	1.99	1.79	5.64	3.25	1.72			1.67	4.49	14.38					4.92	11.67	1.29	2.29	3.00			4.03	5.25	4.53	0	5.68		6.50	4.10	7.84		96.2
EMP40	4.90	6.24	4.68	4.92	0.55			5.17	3.17	5.70	3.80	2.56										4.56	1.59	8.90		4.77	3.70	3.56	5.53		74.3	
EMP48	2.21	0.84		1.39					6.45	7.65	6.21				5.62	5.21						2.56	2.43		2.81	4.19		8.05	5.32	3.72		64.5
EMP56		3.73	3.93	2.58	0.68				5.10	10.75	3.55	0.29			6.38							4.14		6.95	3.70	5.88		6.15	3.27	7.20		74.3
EMP20	4.01	2.55	4.48	4.58	0.38			4.06	5.80	5.60	5.66							2.52	2.44			2.90	2.90	13.06	9.92	7.55		3.62		5.52		87.8
EMP30	3.48	7.05	4.81	3.17												3.23	7.85	2.27				2.50	4.96	7.31	5.20	5.14		3.99		5.06		66.0
EMP51		5.00	4.24		0.56			6.35	4.79	5.74	4.26	1.57			2.30	2.40	2.24											2.45	2.34	6.44		50.7
EMP18	3.52	2.22	0.92	3.13	1.11			0.81		0.90		0.97			2.81	11.45	4.35	9.42	11.26			2.62	6.67	6.70				3.59	2.04	2.09		78.8
EMP26	3.72	3.04	5.22	6.89	4.20			2.36	1.65	3.24	5.12	3.25			2.81	7.20	7.44	9.56	14.10			4.57	11.15	13.99	6.47	4.54		5.31		1.13		129.0
EMP52	0.55	0.93	1.78	1.47	2.84																	0.81	3.30	3.53	5.03	1.49		4.75	3.90	5.37		35.8
EMP13	0.28	0	0.92	0.53	3.04			2.32	3.44	6.60	5.72	2.61			1.22	10.99	20.73	2.72	12.28			6.14	11.99	11.38	5.03	3.73						111.7
EMP41															1.63	5.06	3.25		1.53			4.77	3.69	4.00	4.74	1.41		5.61	3.02	2.05		40.6
EMP47	1.42										1.40	1.62			6.92	6.70	4.20	12.70				1.43	5.76	4.90	4.05					3.33		54.4
EMP12	2.31	2.3																										2.26				6.9
EMP34	0.46															4.84	2.93					5.34	2.97									16.5
EMP23		1.64	3.48	6.55						2.36	0.29						2.63		1.03			1.3				0.73			0.48	1.61		22.3
EMP28				0.59																				2.71	2.06	6.27			1.35			15.0
EMP38					0.59				2.33	1.71	1.4	0.78			7.19	9.63	1.66	13.46			8	3.99	16.36	2.36				7.61	6.23	7.66		91.6
EMP50															4.3			1.91	2.49			1.97	4.43	11.32		5.27			9.1	4.64		45.4
EMP44																	9.06	1.33	6.26					12.11	16.31							47.1
EMP46																	8.81		10.26					13.14	17.69							50.1

Bubble Dosimetry Results for 1994

September	1	2		5	6	7	8	9		12	13	14	15	16		19	20	21	22	23		26	27	28	29	30		Total
EMP2	4.43	4.33			5.08	1.85	1.18	3.80		3.29	3.40					8.47		3.14	8.10	2.18						6.57		55.8
EMP10																15.65		11.59	8.02	4.39		7.03		13.78		5.64		88.1
EMP21	10.42	3.99				1.08	1.84	1.97		3.45	3.49	6.70	6.94	6.88		6.77	7.02	2.59	7.46	2.98		11.44				3.21		88.1
EMP27	7.36	2.12			5.68	2.73	1.98	2.05		5.82	5.02	5.47	5.91	2.88		15.81	4.08		10.00			3.43				6.45		86.6
EMP33	4.47	3.74				3.92		3.21								5.30	6.15	5.19	5.70					6.88				44.6
EMP36	3.47	6.71			4.83	3.58	1.77	3.22		5.86	0.94	6.37	3.77			11.94	6.51	6.16	8.81	4.78		12.84				4.18		97.5
EMP40	3.67	2.83			3.19	0.73	2.11	2.58		2.96	1.81	1.28		3.09		5.24		10.80	8.17	4.17						5.25		57.9
EMP48	3.84	2.33			2.22	2.12	3.14				5.89	5.90	3.78	6.44		11.09	12.05	6.18	9.88	6.10		10.22						91.1
EMP50	12.06	3.46			3.07	1.31				2.19	0.50	3.43		4.35		15.18	10.40	11.62	7.15	1.96		6.34		11.24				94.3
EMP56	4.33	5.13			2.28	3.40		2.48		4.33	3.04	5.86	5.88			12.81	18.18	10.59	13.70			6.28		3.38				101.2
EMP20	2.96	2.46								2.11	1.46	1.23	2.21			3.62	9.11	10.35	12.01	3.62		4.97						56.1
EMP30	7.22	5.87			3.17	2.34				2.83	1.31	1.47	2.84	4.15		4.53	7.81	3.81	6.98			4.22				5.00		62.9
EMP51	2.85	2.84			2.98	0.57	2.78	3.04		4.96	1.15	1.02		2.72		5.58	4.94	7.07	9.03							3.59		54.9
EMP18	2.22	7.62			4.06	1.59	0.97	1.24		3.85	3.98		1.91	2.92		4.57	4.25	2.30	2.77			2.79	6.49	10.22		0.59		64.3
EMP26						0.91	1.78	1.20		2.11	1.89	3.78	1.31	3.40		3.48	2.25	4.37	2.23							0.87		29.5
EMP52	1.79	7.94			2.30	1.08	0.81	0.88		2.72	2.36	8.31	2.16	5.50		5.27	1.72			3.99		4.22		2.25		10.00		61.1
EMP13										2.09		6.78	0.78	2.41		0.89	5.45	3.37	4.38			1.94		8.32		13.07		49.4
EMP41		2.00			1.08						0.92	6.08	0.69	6.32		3.54		4.80						8.80				34.0
EMP47		1.79			1.28	0.28				2.28		3.37		2.85		0.10	0.10	2.32				5.10		3.88				23.3
EMP23	1.88	1.67			1.78	1.81		0.56				3.84								2.29		4.81		2.72		2.58		23.5
EMP28	1.71																		4.18			1.77				0.51		8.1
EMP38		5.69			3.39	1.4				2.54	1.73	7.59	1.78				0.52		0.68							1.82		27.1
EMP44					0.59	2.7		5.22		8.98	9.73	12.57		15.61		0.84	2.57	12.49										71.1
EMP3							1.29	0.8																				2.1
EMP12								0.62																				0.6
EMP46										7.75	5.62	14.47							13.06									40.9

Bubble Dosimetry Results for 1994

October	3	4	5	6	7		10	11	12	13	14		17	18	19	20	21		24	25	26	27	28		31				Total	
EMP2		6.07						3.93	3.78	4.36	1.73		3.96	9.56	5.05					5.40					5.06				48.9	
EMP10	3.05	6.41	2.90	1.33				0.51	3.49		11.87		11.87	10.62	6.16	4.21	4.62		6.70	6.97	0.66	7.75			4.48				95.8	
EMP21		6.55	6.63	0.48	2.20			5.21			1.51			6.70	4.96	3.56	4.44		15.56	7.76	5.53	12.75							83.9	
EMP27	9.28	5.99	4.50	3.85	4.98					4.56	6.17		10.93	10.06	7.29	5.82	6.63		9.36	6.23	10.67	12.69	4.65						123.9	
EMP33		5.21			5.01			2.31	2.13	2.61				2.10		5.34				4.11		1.63							30.5	
EMP36	7.47	6.37	5.40	6.43	4.42			7.78	3.53	1.96	10.59				6.44	6.67	4.60		10.84	4.80	9.26	4.37	4.48						111.8	
EMP40	6.35	7.23	6.91	6.95	7.77			3.54	3.33	2.11	0.91		6.67	6.19	6.99	10.94	4.37			9.78	3.70	6.66	7.13						115.6	
EMP48		11.82	5.99	11.75	4.33			5.63		0.77	6.17		6.78	5.56	4.96	6.36			7.56	3.61		6.05			16.70				104.0	
EMP50								2.19	0.41				3.79	3.99	1.66		6.24		6.53	6.78		4.04	3.71		6.59				52.1	
EMP56		8.69	13.27					12.85	5.46										9.40	7.60	5.60	11.85	4.46		12.42				91.6	
EMP20	6.40	6.26	11.21	9.53	6.05			7.97	5.26	2.59	6.23		6.74	5.23	6.30	6.06	6.39			4.97	6.37	7.57							115.2	
EMP30	7.52	3.58	6.89	4.72	6.08			6.20		2.36	2.96					6.63	3.95			7.12	5.28	6.50	4.01		7.96				82.0	
EMP51	8.92	6.78	9.39	10.22	8.50						1.67	0.71	7.20	8.00	10.07	8.03	4.16				2.87	5.62	7.30		6.01				107.5	
EMP18					3.97					4.95	1.06		4.07	12.76	6.25	2.69	4.62		5.45	7.63	4.25	7.60	4.00		9.69				79.6	
EMP26	4.06	6.66	1.66	5.61	5.75			2.27	12.21	5.17	1.96		2.31	19.17		2.67			5.06	5.26	0.63	10.16	4.65		6.96				103.1	
EMP52	3.23	5.05	4.65	5.65	4.04			4.10	6.73	5.09	0.71		1.93	6.73	5.62	2.56	4.34		2.04	2.42	0.09	0.78	1.72		2.90				70.8	
EMP13	1.65	1.56	5.41		3.16				4.65		2.59		4.65	6.05	4.67		0.42		2.66		5.13		6.70		4.57				54.5	
EMP41		2.64	5.23		0.95			2.46		1.37				0.69			4.17		4.30	5.13	1.94	3.63			2.64				35.6	
EMP47											2.29		0.57	1.73		15.13	4.80		2.53	2.41	2.55	1.44	6.42						41.9	
EMP3	3.6																												3.6	
EMP28	1.71																					2.45							4.2	
EMP38	3.11	4.71	2.15					0.35	6.6	1.67				6.34	0.39		0.67		5.73		0.54	2.63	3.26						36.6	
EMP23		0.56	0.66	0.56	1.36			1.2		1.62	0.95		4.11	4.34	4.13	1.75	2.7		4.66	4.34	2.13	4.29							36.6	
EMP46									11.19		2.64			6.6			7.47		10.59			26.33								69.0
EMP44			2.04										16.46								13.66	16.02								46.2
EMP26															3.66		0.75		2.09											6.7

Bubble Dosimetry Results for 1994

November	1	2	3	4	7	8	9	10	14	15	16	17	18	19	21	22	23	24	25	28	29	30	Total
EMP2	7.14		8.28	6.23		11.88			8.14	7.97	5.88	7.17	14.93		5.14	1.98				11.60	8.88	7.72	112.7
EMP10	5.13		9.34			4.43	2.85	11.27	3.92	1.83	10.22	2.58	4.94	9.98			4.13			6.81	6.05	5.81	89.1
EMP21	4.57	8.64		6.37		11.38	7.92	8.50	6.63	10.80	3.68	5.93	4.84	4.82		2.20	2.63	3.78		1.88	11.45	4.83	108.4
EMP27	17.50	0.29	14.90	4.15		10.56	6.50	13.91	6.22	7.61	5.03	13.50	5.03	12.90		4.81	4.89	1.57		7.02	4.70	6.08	147.2
EMP33							6.38			5.05	5.54	6.41		5.99				5.43		2.65	8.94	10.32	56.7
EMP36		3.13	10.49	6.81		13.87	8.02	11.71	10.38	12.87	17.35	10.23	14.72	14.48		10.07	9.44	2.35					153.9
EMP40	13.22	7.07	8.14	7.12		6.93		7.82	10.35		12.33	2.21				5.98	6.81	3.68		2.29	5.74	9.84	111.1
EMP48		6.52	11.18	5.91				9.44			10.06	6.44				4.22	8.21	3.33			9.25	6.48	79.0
EMP50		3.30	9.97	4.10			6.75				6.99	6.38	6.58	5.94		1.88	2.08				13.37		67.1
EMP56	8.58	6.39	10.73	3.63				7.24		8.08	12.54	10.80	10.54	14.28				3.43					96.2
EMP20				6.87				10.06	6.92		9.77	3.19	5.79			14.21	7.81	2.00			3.64	12.88	63.1
EMP30	4.95	5.93	8.45					8.67	7.85	5.92	6.82	2.25	8.87	4.10		12.72	6.51				6.11	6.70	97.7
EMP51	6.58	7.48	9.59	7.35		12.71		7.17	12.18	6.45		3.36	10.81			4.53	14.23	2.79		4.62	6.80	8.27	124.5
EMP18	8.10	21.08	1.98	7.55		8.16	5.68	5.40	4.44	8.05	9.11	9.37	5.59	9.39	11.32					5.40	11.16	4.82	138.4
EMP26	4.03	11.85	3.58	3.21		7.85	5.11	4.29	5.83	14.48	9.03	11.92	8.33			7.36	6.50	2.96			15.81	5.35	126.9
EMP62		8.10	2.59	3.07		9.39	3.92	2.98		8.74	0.57	1.39	2.88	3.44		4.83	9.47	2.38		9.17	9.95	8.49	91.8
EMP13	6.95	7.65	12.74			8.05	11.18	21.11	5.92	11.62	14.83	15.23	7.89	10.22	18.19		6.46	9.35	3.33		10.10	1.84	182.5
EMP41	7.02					2.88	3.47	4.12	2.28	3.85	3.46	3.59	3.37	4.88			3.27	2.28		2.44	4.67	1.72	53.0
EMP47	5.13	5.17	3.64	1.98		5.84	3.69		3.58	5.38	1.37	1.53	3.68	11.78		6.81	6.19	3.04		4.96		5.75	79.4
EMP44	12.16		3.33	25.60				11.57			7.48	23.33	4.72			18.39	10.81			1.94		6.09	125.2
EMP46	6.52	8.10		25.41					5.88		15.37		18.99			9.85					11.98	15.68	115.5
EMP28	13.79		2.89			4.64		5.89			0.77	0.71									3		31.5
EMP38	1.99	9.82					1.91	0.98	10.48		10.48	2.58	4.95	5.45		5.94	4.48	2.85		9.18	10.38	12.03	89.3
EMP23		4.9	4.88	3.17		8.41	4.31	2.94													4.34	5.75	38.7
EMP3						4.24	2.08	0.17			1.73	2.15	1.87	0.3	11.02		1.21	0.81		0.47	0.43	2.62	28.7
EMP34											3.54						3.77						7.3
December	1	2	3		5	6	7	8	9	12	13	14	15	16	17	19	20	21	22				Total
EMP2	9.83	7.90	13.15		11.83	12.23	8.00	9.25		11.98	7.83	11.17	7.80	6.70	5.34		6.54	4.20	1.38				134.7
EMP10	11.54					13.33	4.59	4.05		7.35		11.88					3.83	3.95	5.23				65.7
EMP21	9.25	10.32	8.40		10.25	12.14	8.21	8.71	8.27	3.92	4.10	7.99	4.19	7.80	4.10		5.42	5.28	1.02	18.14			135.5
EMP27	6.96	10.28				12.07	5.47	10.03	8.19	8.82	11.13	7.59	6.89	4.38			5.47	10.07	7.86	8.30			121.1
EMP33	6.88	5.35				3.88		4.18	4.85	5.28	13.84		1.80	8.17									54.0
EMP36											8.79	8.45	10.79			7.48	7.83	7.15	7.03				55.3
EMP48	3.40	2.12						2.50	10.99	3.85	7.27	5.70	5.43	8.22	5.88		5.13	8.55	6.37				75.4
EMP50		11.40				6.01	12.94	5.93	12.28		14.18	14.19	6.87	8.43			5.98						98.0
EMP56	16.85	11.57	11.16								11.87		4.88		4.04				1.54	6.89			68.6
EMP20	6.79	7.29	6.52																				20.8
EMP30	5.47	6.87	6.91		4.86	11.47		5.50	7.53	6.70	7.54		5.38	4.38	3.49		3.78		4.58	8.46			93.0
EMP40	12.03	6.57	7.54		3.23	7.02	4.87	6.58	8.89	8.23	0.10	8.83	4.84	4.08	9.21		1.10	4.72	7.77	7.53			110.7
EMP51	7.24	8.89	7.22		3.85		5.61	7.17		7.40		9.11	7.10	8.45	11.14		2.14	5.33	7.88	12.80			108.9
EMP18	1.39	2.87	9.67		5.26	11.38	7.84	10.90	3.88	5.86	8.52	3.19	5.09	3.33	8.74		3.88	3.54	1.13	5.88			101.9
EMP26	1.63										2.44	5.85	3.31				2.33	1.83	1.97	5.48			24.8
EMP52	4.50	3.30				10.51	8.36	9.74	4.12	5.95	7.09	4.01	2.80	1.08			1.58	0.77	5.33				86.9
EMP13	13.95	10.55	15.18		9.77	14.07	11.77	8.23		7.28	2.47	5.08	6.73	8.32	11.84		12.73	12.81	7.75	7.48			184.1
EMP41	1.83	2.07	8.53		8.51	8.29	2.64	3.29	1.01	2.49	3.18	0.48	3.11	4.19			4.01	4.43	5.08				63.1
EMP47	5.88	10.77			10.25	6.58	0.80	4.37	2.83	2.35	0.83		1.87	2.41	2.87		2.45	5.28	6.29				65.6
EMP44		17.44			16.22	11.63	8.95	9.42	10.82			12.95											87.4
EMP46		13.83			13.71	7.33	9.95	14.92			3.90												63.6
EMP23	5.87	2.92	8.10		2.48	3.59		4.43			5.19	5.93	2.39				1.74	1.44	2.89				48.8
EMP34	3.88																4.35		3.41				11.6
EMP38	3.54				5.99	9.78					2.35		1.67	6.73			7.84	2.78	1.23				41.7
EMP3			10.00		2.16						1.37												13.5

Bubble Dosimetry Results for 1995

January					3	4	5	6		8	10	11	12	13	14		17	18	19	20		23	24	25	26	27	28		30	31		Total
EMP2										8.92	7.84	6.86	2.66				6.94	9.48	8.21	7.90			7.25	6.64	4.00	8.75	11.37		12.67	4.83		113.3
EMP21										16.27	8.29	6.38	10.28				1.74	12.76	12.18	9.27		10.60	16.21	16.63	10.93	6.94			11.54	5.64		153.6
EMP27					7.28	9.08		3.73		14.64	11.61	1.60	12.24	9.95	12.76		10.04	8.10	10.31	8.98		9.33	8.45	15.24	12.02	19.69			14.93		199.8	
EMP32										2.78	7.55	8.35	3.28	5.96	13.11		6.76	8.18	9.78	8.13		8.07	12.43	8.24	11.58	22.28			15.44	9.38		161.3
EMP33					1.65	4.32				4.75	6.27	2.12	0.73				7.37		3.76				8.77	15.15	8.09	7.44			11.94			81.4
EMP36					6.13	4.43	7.94			9.86	8.50						4.03												4.63	4.49		69.6
EMP50					3.88	6.74				9.45	11.20	8.57	6.59	7.34	10.48											6.35	13.16					64.3
EMP20																	2.88	1.07	10.60	3.11		1.23	6.77	9.51	8.43	3.85			5.94	3.64		57.0
EMP30					3.03	6.14		1.47		6.34	4.46	1.40	5.71	5.87	3.12		6.07	4.73	8.40	3.46		4.03	2.36	0.81	4.73	4.44						76.4
EMP40					2.99	2.82	6.10			1.16	3.30	4.32	6.24					6.49		4.87		3.42	3.37	2.38	3.31				7.13	19.13		77.0
EMP51					3.81		8.26			2.13		5.90	7.49				3.36	8.26	11.03	6.40			2.72	2.67	2.76	4.83			7.55	7.04		83.2
EMP44										23.44			16.93				2.69		12.17	8.77		8.12	12.74	10.65	16.87	6.32						118.7
EMP46										18.62	3.85		23.02	15.37	12.63				0.89	5.57					10.52	14.58						105.0
EMP18					2.38	4.72	1.06			5.01	4.69	0.65			8.83		6.06	15.34	8.72	8.82		8.01	5.81	4.03	6.70	8.12			3.78	7.68		110.4
EMP26					1.82	2.99	5.48			3.67	2.15	2.66	2.38				3.67	19.02	8.23	4.62		6.73		4.46	4.41				9.74	7.15		89.1
EMP52					0.87	1.28		6.51		4.42	8.45	0.61	2.31	2.05			2.22	10.53	6.56	10.40		3.63		2.27	3.79	7.25			4.13	4.24		80.4
EMP13					12.08	6.28		4.71		11.82	6.60	10.82	15.17	10.81			3.78	5.43	5.43			4.41	4.36	8.30	6.32	4.27	9.53		9.62	5.71		147.7
EMP41					3.93	5.56	4.58			5.04	4.08	3.70	5.83	1.67			5.24	4.42	2.69	1.41		3.45			0.35	6.73	15.44		3.14	1.50		78.8
EMP47					3.13	6.63				4.25	1.62	6.50	3.77	1.10	4.78		4.23		3.23	0.68					0.64	3.30		13.31				57.2
February					1	2	3	4		6	7	8	9	10	11		13	14	15	16	17		21	22	23	24	25		27	28		Total
EMP2					10.4	11.1	5.48			10.77	9.46	14.36	0.79		10.39		6.26	1.63	6.66	3.08					10.70			5.84	4.84		110.8	
EMP10																							10.15	5.61	3.24	5.03	6.83			9.40		40.3
EMP13					4.4		4.51	5.83		3.02	14.07	18.59	11.25	10.70			12.72	9.01		7.39	0.48		11.86	10.73	12.98	5.66			14.21	4.66		162.3
EMP21					9.19	10.7	8.89			12.12	9.42	10.60	7.87	2.62			3.15	3.06	5.75	2.21	6.59		10.21	8.95	5.22	2.61	10.23		1.77	5.61		136.7
EMP27					12.1	13.3	6.29			19.53	11.58	6.12	12.79	6.07	13.02		12.62	1.94	5.44	2.67	9.48		8.24	9.20	1.67	2.90	7.92		5.59	7.82		176.2
EMP32					17	12	10.27			7.09	3.71	9.50	8.44	15.04			7.39	7.10	4.50	11.17		5.28	7.93	11.57	4.02	11.22			10.54		163.8	
EMP33					7.72	8.7				7.13	8.11	6.72	5.08				7.68		3.07	6.77		6.29	5.77	7.03	2.26	7.47		3.77	4.66		96.2	
EMP36					3.6	12	8.92			8.00	8.98	6.19	7.98					6.63	3.47	3.92		13.68	6.27	7.64	4.44	8.63			7.22		117.5	
EMP20					4.42	10.1	10.79			4.34		6.95	14.06	15.14			5.57	6.07	5.48				9.72	11.82		5.78			2.40	6.72		119.3
EMP30					6.6	8.32	8.69			6.93	5.66	11.70	5.42	6.67			8.46	6.87	13.81	3.18	6.78		7.60	8.79	10.10	3.26			6.29		135.1	
EMP40					5.19	10.3	9.14			2.45	4.55	4.37	6.19	6.40	9.10							7.49	6.03	10.05	7.22	6.44		7.33	5.43		107.7	
EMP51						10.4	8.08			3.77	3.97	7.77	7.78	6.50	8.53		5.17	4.51	13.81				8.43	9.42	4.74	9.40		9.71	4.44		126.4	
EMP44					16.3	13.9		20.12		10.10					5.62		5.94	0.77	21.57	1.96		1.97		8.25					8.33		114.8	
EMP46					12.7			11.87		9.18									22.41					10.45	10.95	17.40						95.0
EMP14						8.97				6.83	2.19	11.14	3.13	2.96			1.82	3.95	1.58	1.92			1.17	3.77	6.61			10.08	4.85		71.0	
EMP16					4.84	13.3	4.69	4.37		6.51	9.88	7.65	10.70	10.38	6.79		7.24	6.57	6.77			1.16	4.12	11.19	6.35			3.43			124.9	
EMP26					3.46	9.48				6.41	4.07	10.16	3.61				9.02	5.57	5.67	1.74				5.28	5.00			9.97	7.90		87.2	
EMP52					1.54	14.7	8.43			10.19		9.14	12.72	2.60			9.32	6.20	7.70	2.93		2.80		9.37	6.64				5.61		109.9	
EMP41					2.37	5.67	3.70	7.57		9.58	0.43	2.01					5.79	5.47	8.56	6.88	0.99		0.78	10.52	7.93		2.67		29.15		110.1	
EMP47					1.79	2.34	1.08			3.52	1.00		1.39						5.08				0.23		4.10	1.81	2.68		4.05			29.1

Bubble Dosimetry Results for 1995

March					1	2	3		6	7	8	9	10	11		13	14	15	16	17		20	21	22	23	24	25		27	28	29	30	31	Total	
EMP2					4.47	4.42			4.91	3.31	6.40	8.37	4.05	9.80			9.77	3.44				7.78		4.66	5.04	6.21	9.05							91.7	
EMP10						8.14	2.75		4.61		6.45	8.10				2.64	4.71						5.67	0.61		2.80			10.49	8.58	12.36	5.69		83.5	
EMP13						12.15	6.42		9.01	8.87	4.69	8.58	9.39			8.99	11.38	1.00					4.45	4.69	12.53	12.64				6.11	12.22	3.68		138.8	
EMP21					1.39	6.79	3.36		2.27	4.25	4.88	7.77	1.21	6.92		6.78		2.33	6.29	6.15		6.36	0.49	3.25	5.40						3.41		79.3		
EMP27					7.55	5.51	6.39		9.46	9.01	2.29	11.88	9.22	4.96		8.19	7.05	7.16	8.71	7.41		10.92	4.97	4.41	6.50	6.94	8.90				7.04	13.23	167.7		
EMP29									6.11	5.28	2.11	4.58	3.78		3.62	6.19														7.83	11.13	4.28	10.55	94.2	
EMP32					5.81	1.40	7.49		0.36	1.73	7.31		3.81	10.48		2.28	6.29	0.28				2.97	0.86	4.09						7.31	2.69	2.90		68.0	
EMP33									4.05	7.66	5.69	7.83	3.40			5.25	5.24	2.30	4.98				5.69	5.19	5.13	8.59					5.04		7.07	83.2	
EMP36					1.7	2.74	3.50		0.51	3.31	4.26	7.24	2.61			4.89	1.39	8.22	7.29	8.37															
EMP20					6.18	4.62	2.70		3.07	3.36	3.65		5.62			0.66							3.68												
EMP30					7.28	5.65	4.48		8.28	1.82	4.48	9.73	8.74					4.91		6.42		5.77					6.13				6.60	8.42	5.16		
EMP40					7.85				5.96	3.21		6.70				6.15	7.50	8.70	7.11	5.34								6.73	3.96		6.42	7.56	12.00	6.26	
EMP51					8.31	0.89			8.89	3.30	5.90	7.26					3.73	3.26	7.52	7.51		4.50		3.83				9.66	5.81		4.38		6.70		91.4
EMP6						5.09	0.31		1.82					11.48																					
EMP39						2.56	1.97			12.38				13.41					6.00	19.81	22.53														
EMP44					5.44												0.78																		
EMP46														10.83			21.98		24.72	25.26		11.68													
EMP14					3.93	7.35	5.43		10.26	2.84	9.39	4.78	5.94			2.96	5.63	7.85	6.67	2.88		3.55	0.84	3.26	0.29	4.09	5.02		6.47	3.65	2.49	2.16	4.46	112.2	
EMP17									3.00	0.15	6.82	5.02	4.74			3.36	5.91		3.59	2.69		6.67	3.93	2.68	2.66	3.75	8.29			3.40	7.43	26.33	7.88	106.2	
EMP18					2.14		1.36		5.25	2.81	8.75					6.51	8.64	8.72				5.69		4.01	9.44	7.14	9.28		12.05			7.43	10.25	11.18	120.7
EMP26					6.86	6.03			6.05			2.76				4.28	2.89	6.97	3.52			5.65	3.40	4.13	5.64		3.27		7.59	2.83	3.33	3.88	4.19	82.3	
EMP52					3.52	3.23	3.51		6.06		2.20	4.53	3.33			4.94	4.64	2.61				6.67	4.22		0.88								2.26	51.6	
EMP41						7.40	6.58		2.66	7.46	6.01	7.59	7.15	13.30		17.69	11.13	7.62	21.96	8.97		4.80	6.83	6.10		8.62	9.65			7.81			3.77	173.1	
EMP47					0.71		6.57		2.39	4.44		2.56	7.96				6.76	6.20		1.98		6.06	3.84	3.48		13.28					12.69			78.9	
April					3	4	5	6	7	8		10	11	12	13	14		17	18	19	20	21	22		24	25	26	27	28				Total		
EMP2												7.73	7.92	5.86	7.31	6.30		4.67	5.02	4.72	5.58	9.42	3.76		10.67	8.19	9.44	6.74						103.3	
EMP10					8.16		5.08		4.18	6.64				0.32												13.21	9.47							47.1	
EMP13					13.6	14.36	15.40							6.80	17.88	5.28		14.68	14.96	7.13	15.66	13.41			11.73		14.26							164.7	
EMP21					12.9	10.9	7.40	6.58	1.65		4.29	3.87	0.67	6.88			7.29	5.83	5.53	1.48	4.50			12.66		6.52	6.34	4.55						109.7	
EMP27					8.5		3.67	11.08		10.97		5.63	9.00	3.30	5.00		5.27	4.18	2.67						9.17	2.74	7.22	5.51						93.8	
EMP29						7.86	8.84	9.06	2.74			4.10	6.75	4.84	5.09			8.73	4.78	7.55	9.62	2.12		9.49	5.49	8.69	8.33	5.61						119.7	
EMP32						3.29			14.13	12.55				7.21	12.38	1.47		8.62	7.64	7.64	12.99	6.15					9.56	8.31	4.30					116.2	
EMP33							2.94	5.76	3.39	5.99			6.99	3.63	2.99	3.41			6.07	1.05	5.48	8.36					7.09							63.1	
EMP36					8.43		10.17	11.59			10.97				11.52		11.52	5.31	5.48	9.66	5.33				3.15	5.24	4.88	2.00						105.3	
EMP55						4.69			5.61		11.80	7.87	7.24	8.38	8.32		9.21																	63.1	
EMP20						5.15			4.54		3.37	10.46	5.53	7.24	7.58		0.94	8.11		1.89					1.74		1.99	1.86						60.4	
EMP30					8.21			7.01				8.70	5.91					5.21			4.41							3.09	2.34					44.9	
EMP40					5.12			3.93	9.34			7.63	8.99	1.30	8.52					7.00														60.2	
EMP51					5.88			5.12			6.32	7.42	8.41	9.59					7.75	4.98								0.83	7.55					63.9	
EMP6					2.9		9.63	15.50	6.06	12.22		2.56	17.69	8.63	5.87		2.36	0.95		0.24	3.47			0.30										88.4	
EMP39					4.55		7.81	6.33	11.51	10.43		23.13	11.54	2.25				6.34		11.16	4.31	1.90				10.11								111.4	
EMP44						5.05	10.88	8.46						3.67																					39.5
EMP46							11.73	8.77			3.30	26.22	10.65							11.16															88.9
EMP14						4.05	12.21	14.36	13.21	13.78		2.97	5.24	10.08	10.41			5.65	7.63	9.65	9.21				6.97	5.71	5.42	3.84	1.63					141.9	
EMP17						9.64		8.27	10.13			4.05	13.02	4.01	8.10	6.52		6.89	5.46	2.62	10.83				8.80	4.62	4.16	1.16						108.3	
EMP18					10.2	9.56	8.50	9.62	9.06		10.08	21.69	14.02		5.04		2.02	6.43		5.49	7.14	9.40		7.80	3.81	1.30								141.1	
EMP28					10.2		6.18	4.95			13.77	5.64	7.27	3.33			2.91	4.93	4.16	10.10				13.04	0.83	3.07	2.51							92.9	
EMP52					2.91			5.63	12.83		5.63		2.99	3.65	2.56		1.11	8.84		4.62	16.92													79.0	
EMP41						14.2		3.21	12.90	15.66		1.61	15.83		0.69		2.61	3.63	5.92								4.67	1.41	1.94	2.44				79.0	
EMP47					13.6			6.89																											

Bubble Dosimetry Results for 1995

May				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Bubble Dosimetry Results for 1995

July					1	5	6	7		10	11	12	13	14		17	18	19	20	21		24	25	26	27	28	29		31		Total	
EMP2					9.33						13.33	6.72										12.69	1.79								60.4	
EMP10					12.7						7.42	7.54	6.11	6.63										3.26							51.2	
EMP13					11	13.4	22.76				14.96	19.33	16.56	18.01																	1.27	
EMP21					4.61																											163.3
EMP27					11.2	8.67	9.69				5.69	10.56	7.94	10.06																	99.7	
EMP28					9.09	7.87	16.63				8.63	15.09	16.64	8.08																	726.1	
EMP32											11.71			12.98																	83.6	
EMP33					4.31								10.65																		29.5	
EMP36					7.18	8.96	11.01				11.66	9.83	10.60	15.94																	122.0	
EMP34					11	8.23	7.31				11.86		11.45	19.22																	166.7	
EMP36					12.1	10.8	11.19				12.71		11.71																			8.05
EMP30						9.84					6.04			4.43																		49.2
EMP40											6.69	6.64																				66.2
EMP40					11.6	9.83					6.77	9.47	6.16																			66.1
EMP41					1.77	11.89					13.30		10.00	7.24																		97.0
EMP38					18.86						20.83			11.49																		70.9
EMP44					4.84						14.98																					44.1
EMP44											22.61																					41.0
EMP14					9.22	11.36					13.89	13.33		9.70																		136.6
EMP17					9.02	10.61					12.32	9.74	8.52	9.17																		118.0
EMP18					8.4	7.84	6.52				6.12	4.81	2.88																			82.2
EMP28														1.61																		90.6
EMP47						18.79					4.98	6.71	10.26																			73.8
EMP32					1.57	4.3	2.76				7.22	7.46	6.63																			102.3
August					1	2	3	4			7	8	9	10	11	12																Total
EMP2																																
EMP10					4.48	10.89								6.16	14.09	7.62	12.32	16.75														
EMP21														6.92																		
EMP27					14.8	10.93	10.42						6.64	7.17	2.83																	
EMP28					16.8	12.19	9.48						13.68	6.28	8.88	13.61																
EMP32					14.2	8.81	16.79						9.61	7.85	6.84																	
EMP33					5.67																											
EMP36																																
EMP34					10.6	10.28	10.69						11.36																			
EMP36					14.7	16.46	10.28	11.03					9.41	4.96	9.35																	
EMP30					9.63	10.98	10.03						10.89	6.23	6.26	4.64																
EMP40					8.98								9.40	6.65	7.85	11.10																
EMP31																																
EMP36					5.7								10.97	10.66	6.87	6.46																
EMP46													13.17	15.23	5.93	6.67																
EMP46					5.95	8.63	10.12						7.28	10.44																		
EMP17					4.04	3.21	2.14	9.83					8.13	9.31																		
EMP18					3.83	1.48	3.63	8.25					4.94	3.05	6.49	6.96																
EMP26					3.92	1.81	6.31	7.84					13.68	6.13	4.64																	
EMP47					9.93	6.39	6.31						6.30	4.01	3.43	9.22																
EMP32					16.7	9.62	5.96	2.98																								
																				</												

Bubble Dosimetry Results for 1995

September	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	
EMP2			6.41	7.25	5.37																												90.1
EMP10						5.89	14.64						5.04	3.70				8.84	5.08	10.93			10.56	6.67		9.56						21.1	
EMP21																		1.11						22.64		20.63						66.4	
EMP27											6.02						6.62							7.82	6.67	7.56	7.99					97.0	
EMP34	4.79	3.61			9.72	8.31				9.07	4.20								8.61	9.38	6.03		4.98	9.81	13.40	10.16	3.90				72.6		
EMP38										0.68									3.18				7.62	6.05								96.8	
EMP55										9.19	5.38	9.26						3.00	5.99	6.71			6.17	16.53	8.57	2.98	12.45					133.7	
EMP60	6.41	6.17			4.22	7.99				4.01	9.74	8.29	11.16					4.10	8.61				6.47	11.65	7.24	10.46	13.66					43.6	
EMP20	6.78				5.23	4.82					3.16						2.64	6.42														80.1	
EMP30												6.94					4.18	7.81	3.76	8.21	4.67											32.2	
EMP40	5.74									9.79	6.96	1.99																				80.2	
EMP51	4.7	7.47			10.91					6.68	6.81						3.63	9.06	7.93	10.26		4.51	3.33			2.67						81.9	
EMP6	3.2	6.71			8.06	4.19				3.97	2.50						6.04	10.41	4.91	6.91		1.88	2.88	11.98	8.20							26.8	
EMP8																																	38.1
EMP48																		7.42		7.04	5.44		7.01	6.08		6.63						63.8	
EMP14																																	68.8
EMP17																																	72.0
EMP18																																	70.7
EMP19																																	92.6
EMP26	9.03	4.48			2.09					3.41	4.39	7.33																					60.9
EMP47	5.68	6.19								3.33	6.28																						74.2
EMP52	5.94				2.99	3.41				6.74	7.80	2.60	4.67																				
October																																	
EMP2																																	
EMP10																																	
EMP21																																	
EMP27																																	
EMP34																																	
EMP44																																	
EMP54																																	
EMP55																																	
EMP60																																	
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EMP17																																	
EMP18																																	
EMP26																																	
EMP47																																	
EMP52																																	
Total																																	

Bubble Dosimetry Results for 1995

November				1	2	3		6	7	8	9	10		13	14	15	16	17		20	21	22	23	24		27	28	29	30					Total
EMP2						15.81			10.91	4.33						2.32		9.68		8.95		9.09							10.76					71.9
EMP10						3.38			2.95	3.18						2.87		11.80	3.76															27.9
EMP21									12.64																			11.15		12.31				36.0
EMP27								2.86	6.38	6.75						6.18		8.97		10.99	6.05							8.38	9.20	9.92				73.7
EMP36								3.16	4.10						13.38	2.35	1.48		3.16	6.08	4.58	5.92					5.40	3.67	9.15				59.3	
EMP54						3.84		6.38	6.26	7.42					8.84	1.56		9.29		10.63		7.48					8.88	6.55	6.50				83.6	
EMP55								5.85	5.37	0.92					9.19	3.09	4.84	11.16		10.51	0.71	7.24					4.87	6.98					70.7	
EMP20			7.18		4.14			3.42	5.94						3.11			8.94		11.56	8.42						7.95	5.68	9.91				76.3	
EMP30					7.19					7.40								5.74		12.87									4.34	7.66				45.2
EMP40									9.02	8.60																								17.6
EMP51						3.98			10.62	4.31							8.77				6.42								6.11					40.2
EMP4									8.09	4.35						5.13		4.25		2.76							11.22	8.51	9.44					53.8
EMP6			8.49		1.94				4.12							2.32		9.37	4.24		2.02	4.37					11.88		31.67					80.4
EMP46																		5.53		3.09														8.6
EMP14						5.83		4.14	5.80	6.19					7.78	8.95	4.33	6.20		4.69		5.38							5.09	5.11				69.5
EMP17			4.5		3.69			3.14	2.91	5.00					8.09	9.02	5.50	5.24		4.96	4.64	2.90					7.72	3.54	3.95					74.8
EMP18					4.04				4.06						4.88	5.71	1.88	5.24		2.29							3.21		5.64					36.8
EMP19			7.24		3.54			3.89	4.39	4.18					1.37	12.72	4.51	6.18		0.80	6.32						4.07	2.00						61.2
EMP26			6.35		6.58			3.92	4.92	6.20					5.33	7.52	8.90	7.61											1.52	6.18				65.0
EMP47																		2.01											5.41					7.4
EMP52						2.15		6.32	4.16							5.63		2.38			6.62	3.21							5.26					35.7
December		1	2		4	5	6	7	8		11	12	13	14	15		18	19	20	21	22												Total	
EMP2		10.13												15.88	10.50	15.02		9.17		9.10	7.79												77.57	
EMP10									5.67						6.54			17.81																30.02
EMP21			11.63				10.58								19.54	10.00				14.25														66
EMP27			10.68		7.96	6.71	4.39	8.52	12.22					10.83	5.08	8.73	8.11		7.51	2.51														93.25
EMP36		6.55			4.09		5.97	4.68	12.16					4.80							7.37													45.62
EMP55		8.92	9.76		15.8	11.7	11.21	12.89	11.05					13.48	9.87	7.15	16.50		7.88	5.14	16.31	4.67												162.3
EMP20		10.16	6.67		7.25	5.32	10.41	8.48	13.59					9.22	1.94	5.88	13.88		15.20	6.27	12.22	9.16												135.7
EMP30		5.88			5.77		9.28	6.71	12.31					6.10		6.50	10.81		11.45	5.61		9.39												88.81
EMP4		18.63	10.45			13.5	9.00		14.32					25.05	12.71	11.62		14.05																129.3
EMP6		10.07	14.74		4.86	6.36	4.33	3.80	13.73					7.57	8.47	2.02																		75.95
EMP46		10.63	8.91				7.85		12.14					4.76			16.16		13.49	10.58	24.14													108.7
EMP14		11.48			2.81	8.42	8.07		4.80					8.17	6.98	8.35	7.16		8.59	9.43	11.00													95.28
EMP17		9.13			9.23	7.52	4.50	2.70	4.79					6.39	2.54	9.91	7.70		9.01	8.88	4.08	5.78												92.16
EMP18		13.63			6.78	9.51	8.10	8.37						4.01	7.60	4.83					7.40	1.67												71.88
EMP19		6.26			5.48	2.84	5.11							4.63	4.46	10.72	8.92		6.63	6.71	4.30	8.66											74.72	
EMP26		15			5	3.14	6.67							9.23		14.80	2.88			8.92	8.90													74.54
EMP47					11.7	10.6								5.28																				27.54
EMP52		8.77			5.57	5.08								2.79	5.31	7.09	9.47		10.91		5.74													60.73

Bubble Dosimetry Results for 1996

January	3	4	5	6	8	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	28	29	30	31	Total
EMP2		23						5.17	18.16			10.46	24.1				4.73	14.62	10.92					19.79	130.94
EMP4					4.69			13.18				6.88	34.7				22.82	6.51	13.91			16.9		27.24	146.76
EMP23							5.4	6.55																	11.95
EMP27					7.86		2.25	3.29	11.59		8.54	8.14					7.63	8.68	10			22.9	8.94		99.81
EMP28					9.87		5.19	19.14	7.96		7.84	5.48	9.11					10.68				18.6	9.74	15.14	118.70
EMP36	2.78	4.34			6.94		4.91	9.11						14.22		16.5	3.5	11.95					14.56	10.51	99.34
EMP20		11.4			12.6		10.44	13.59	7.81		5.73	9.02	10.4				12.7	9.67	13.06						126.45
EMP30		10.8			8.2		7.42	13.95	9.32		7.87		8.35			8.27	10.51	13.49							110.47
EMP40																									17.34
EMP51	9.04	12.3			9.02		11.67		20.36		8.97	11.49	18.5			13.3		27.72					12.78	13.22	168.43
EMP46																		4.48	11.5						15.96
EMP18		4.33			5.88		27.56	9.45			8.17	8.74	11.9			7.45	18.13	12.93	6.48			4.28		5.57	130.87
EMP52							20.78	17.24			19.3		3.29			24.1		19.19							103.86
EMP13		23.7			12.46																				36.11
EMP47							20.89	17.98			8.04	6.1	18.4												84.64
EMP14	2.7	6.14			4.24		15.39						14.4				1.44	6.15				9.12	6.1	13.86	79.67
EMP17	5.65	6.59															2.14	4.8	11.94						66.64
EMP19	4.85	6.96			7.72		6.48	15.67	12.63				6.73			10.5	12.19	8.23	4.59				10.86	9.86	117.15
EMP10		6.53						5.41											8.09						20.03
EMP55	8.11	17.2			8.65		10.04	6.68	16.14		6.63	6.27	16.1			9.58	13.56	7.98	11.5						138.22
EMP54					11.32		13.33	12.89	21.78		7.25	13.99	22.3			15.3	20	21.59	10.88						20.03
EMP29		15.2			7.56		17.14	11.11			14.9	13.02	13.3					19.85	9.62			31.7		11.71	214.07
EMP16		12.3			11.36			24.05			27.67	24.2				35.5	35.79	19.75	8.74				28.51	17.56	143.29
EMP8		24.1			18			13.97			11.7	16.71	19.7					36.88					18.77		245.43
EMP9																							10		159.80
																									10.00
February	1	2	6	7	8	9	10	12	13	14	15	16	21	22	23	24	26	27	28	29	Total				
EMP2	15.91				15.96	17.52	6.53	5.38	9.23	4.57	5.22	6.96	1.86	2.03				1.97	7.29	7.44	107.87				
EMP4					40.23		32.56		9										18.84	17.5	118.11				
EMP27	5.82		6.18		6.97	12.06	7.1		8.05	12			5.34	6.18	10.6	6.04		6.48	6.94	9.8	10.6	122.19			
EMP28	6.26			4.72		12.72			14.47		5.08		5.61		8.77			7.93	12.22	7.68	20.3	105.76			
EMP36	20.39						6.34		8.25	6.91	11.69			12.7						2.18		68.50			
EMP20	8.87	13.2	10.9	15.57	7.67		10	7.9		9.75	3.88	6.09	2.17	4.89	3.51	9.9	13.86		7.59	20.8	156.56				
EMP30	8.75				13.19	7.72	5.65	9.35	8.15		3.5		2.96	7		13.54		16.07	9.71	13.3	118.92				
EMP40	11.49		10.5	13	9.28	3.82	8.51		10.16		3.48		4.05	8.83	6.87			8.66	11.69	4.37	114.70				
EMP51	17.57		9.65	16.14	13.18	8.83	9.95	18.24	14.28	14.7	2.05			5.59				23.99	10.2	13.9	178.29				
EMP46		31.2			12.46	13.45	21.84	6.57		14.4	31.64			17					18.59		167.15				
EMP18					7.04	11.85			11.7	20.34	7.68	10.58	2.16	14.5	7.7		4.31			13.9	111.84				
EMP52	29.07		27.7	33.79	18.9	9.94		10.53	11.24	16.1	16.16			22.6	16.34		18.88	7.1		8.22	248.51				
EMP13																9.72		15.99				25.71			
EMP47									8.54	11								11.95	6.16	6.91	44.58				
EMP14	13.02		9.95	9.08					13.89	8.83	17.17		5.96	5.73	4.17		5.19	11.97	5.19	13	123.10				
EMP17	9.37		12.6		11.17	6.33		9.32	9.62	14.2	18.92								9.17	6	106.60				
EMP19	7.72		6.44	9.52		12.26		8.14	18.05				3.82	11.6	6.63		13.84	8.61	14.58	13.3	136.48				
EMP10			7.92	13.5			5.3		16.47						1.03		3.85	11.99		21.1	81.19				
EMP55	8.11	16.8	16.7	19.79	19.31	9.15	13.1		14.29	9.06	19.46		10.7	12.3	6.62	16.33	11.79		18.06	15.2	236.70				
EMP54	19.36		13.9	12.35	10.09		10.34		16.38	16.46	15.3		18.5	7.84	8.78	13.71	11.84	24.46	13.06	8.62	220.78				
EMP29			23.1		27.93	28.44			28.04	9.27	26.16		4.22	13.6	11.17	17.98	5.25	11.67			206.83				
EMP16	5.1	10.1	12	27.86	22.24	5.77	10.25	20.17	19.52	22.3	13.19		6.58	16.8	3.22	16.71	9.11	16.65	16.44	32.8	285.84				
EMP8	22.66		20.3	17.52		17.19	10.41	20	9.87	6.3			1.33	18.2	9.11		12.68				165.33				
EMP9					10.77	9.61	7.36	5.17	6.43	8.86	1.2	3.66		3.6	4.4	0.62	11.46	17.43	12.26	9.38	14.3	126.49			

Bubble Dosimetry Results for 1996

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Bubble Dosimetry Results for 1996

May		1	2	3	4	5	6	7	8	9		11		13	14	15	16	17	18	19	20	21	22	23	24	25		27	28	29	30	31	Total
EMP2		9.61	20.9	20.2					14.83	22.66					17.6	9.48		19.7				20.28	25.09	23.14	25.59	19.9			51.52	18.57	24.9	26.8	370.66
EMP4			17.3				9.79									11.32	25.3		20.7			21.38		55.83								34.4	196.06
EMP27		6.58	11.5	19.6			11.11		6.27	10.48		11.29			8.79	8.72	6.91	11.7			13.71		16.02	15.31								13.5	171.61
EMP36		8.05	6.27	8.87	14.84	20			5.59					22.87					19											8.07			113.40
EMP20		4.78	10.3	18.4	13.6			11.32	2.57	16.47				12.77	18.9	10.29	12.5	13	20.8	37.12		17.97	17.88	20				11.69		8	15.5	293.79	
EMP30		4.94	14.7	26.3					8.45	6.74					18.6		8	19.4		28.25		14.94		27.5					15.08	12.6	17.8	222.26	
EMP40			23.8																														23.77
EMP51		23	12.1						9.23	13.18				11.08	15.3	17.33	20.3			22		18.25		21.51				24.42	18.1	20.9		246.68	
EMP18			7.56		16.67	12.61	12.35	3.78							14	7.41	7.79	17.9					8.71								43.1	151.96	
EMP52			8.42	21.2			8.74	16.89	18.31					27.76		22.14	6.02	29.8						23.05								43	225.32
EMP13					28.7			8.1	21.85		15.23					27.41	31	29.6		35.65													197.48
EMP47			10.3	24.7				16.78	19.34							9.38	12.3				10.5	23.9	19.64						6.26			153.09	
EMP14		11.8	14.2	14.3			13.87		8.19	13.77												10.92	6.72	8.18					10.48	23.1		135.40	
EMP17		5.49		15.6			5.78	5.88	2.56	8.59					5.45	9.32	4.79	7.43					8.68	4.48						6.53		90.66	
EMP19		19.2	13.5				13.33	9.38	12.08																								67.55
EMP10		13.9					1.2	10.78						8.16	11.6							11.29	5.48	28.85					8.36	15.5	13.8	129.02	
EMP55			15.3	30.7			11.81	15.62	7.95	12.49					25.1	10.83	29.3	18.9			19.85	17.85	13.91	27.45				25.26	20.94	29.6		333.00	
EMP54		20.5					9.5		6.36							15.04																	51.40
EMP29		16.2	19.9				14.91	17.51	13.22	6.14				16.17	23.4	13.68		11.3			31.95	19.81	27.37	24.51						20.4	21.4	297.59	
EMP16		21.4	19.7	23.4			16.05	16.88	6.61					18.97		18.24	22.6			24.87	19.87	27.06	22.05	42.14					27.79	37		363.84	
EMP8		16.4	14.9	23.1	19.27		15.25	11.15	8.77	16.67					15.4	15.91	20.6	24.4	23			26.72	22.24			19.9			17.48	20.63	21	18.4	371.10
EMP9		5.48	14.3	25.7	8.1		19.87		12.85	7.57				10.16	11.5		11.8	19.5		27.02		14.53	23.03	20.56					19.55	16.26	8.39	276.17	
EMP23		8.12																18.5	17.8														44.36
EMP46								19.23							7.41		28.1	9.48	16.7			22.19		27.59									127.71
EMP39				7.06															16.5														23.53
EMP28																			18.7														18.67

**APPENDIX C: MONTHLY TLD AND BUBBLE DOSIMETRY RESULTS FOR
STUDY COHORT**

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
Person		Month	Year	Dose (mrem)	Dose (mrem)	Dose (mrem)	NCF	Dose (mrem)	% Diff.
EMP1		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.4		
		12	1993	0	0	0	0.2		
		1	1994	18	0	0	0.2		
		2	1994	11	11	24	0.2		
		3	1994	21	20	93	0.4	56.1	39.68
		4	1994	0	0	22	0.4	15.79	28.23
		5	1994	17	17	37	0.4	6.16	83.35
		6	1994	0	0	26	0.4	33.13	-27.4
		7	1994	0	0	31	0.4	21.5	30.65
		8	1994	0	0	25	0.4	5.67	77.32
		9	1994	15	14	48	0.4		
		10	1994	16	15	68	0.7		
		11	1994	13	13	79	0.7		
		12	1994	0	0	11	0.7		
		1	1995	16	16	74	0.7		
		2	1995	0	0	47	0.7		
		3	1995	20	19	96	0.7		
		4	1995	0	0	18	0.7		
		5	1995	0	0	82	0.7		
		6	1995	13	0	54	0.7		
		7	1995	0	0	45	0.7		
		8	1995	0	0	36	0.7		
		9	1995	0	0	0	0.22		
		10	1995	0	0	0	0.7		
		11	1995	0	0	0	0.7		
		12	1995	0	0	0	0.7		
		Total		38	37	234		138.35	231.83
		Average		6.33	6.17	39		23.06	38.64
		Variance		97.87	92.17	727.6		367.27	1606
		Std Deviation		9.89	9.6	26.97		19.16	40.08

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP2		5	1993	0	0	25	0.7		
		6	1993	0	0	13	0.7		
		7	1993	22	22	66	0.7		
		8	1993	0	0	12	0.7		
		9	1993	0	0	13	0.7		
		10	1993	0	0	17	0.7		
		11	1993	0	0	12	0.7		
		12	1993	0	0	12	0.7		
		1	1994	0	0	28	0.7		
		2	1994	15	0	34	0.7		
		3	1994	11	11	19	0.7		
		4	1994	0	0	10	0.7		
		5	1994	0	0	8	0.7		
		6	1994	0	0	11	0.7		
		7	1994	0	0	21	0.2	19.69	-6.24
		8	1994	20	19	54	0.2	87.6	62.22
		9	1994	23	22	60	0.2	55.6	-7.33
		10	1994	21	13	30	0.2	48.9	63
		11	1994	44	38	91	0.2	112.7	23.85
		12	1994	54	48	104	0.2	134.7	29.52
		1	1995	48	46	103	0.2	113.3	10
		2	1995	34	31	87	0.2	110.8	27.36
		3	1995	36	32	69	0.2	91.7	32.9
		4	1995	45	40	87	0.2	103.3	18.74
		5	1995	55	52	163	0.2	118.6	-27.2
		6	1995	44	42	124	0.2	88.3	-28.8
		7	1995	40	40	94	0.2	60.4	-35.7
		8	1995	74	70	206	0.2	158	-23.3
		9	1995	21	21	80	0.2	60	-25
		10	1995	38	36	130	0.2	90.1	-30.7
		11	1995	25	24	97	0.2	71.9	-25.9
		12	1995	24	23	70	0.2	77.57	10.81
		1	1996	29	28	115	0.2	130.9	13.86
		2	1996	19	16	58	0.2	107.9	85.98
		3	1996	40	38	179	0.2	224.7	25.53
		4	1996	37	37	166	0.2	195.7	17.9
		5	1996	72	70	272	0.2	370.7	36.27
		Total		843	786	2460		2633.06	247.77
		Average		36.65	34.17	106.96		114.48	10.77
		Variance		299.24	280.24	3424.77		5250.53	1118
		Std Deviation		17.3	16.74	58.52		72.46	33.44

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP3	5	1993	0	0	0	0.7		
	6	1993	0	0	0	0.7		
	7	1993	0	0	10	0.7		
	8	1993	0	0	14	0.7		
	9	1993	0	0	18	0.7		
	10	1993	0	0	0	0.7		
	11	1993	19	15	132	0.7	42.13	-68.08
	12	1993	36	35	89	0.2	88.92	-0.09
	1	1994	28	28	117	0.2	86.1	-26.41
	2	1994	86	80	194	0.2	107.6	-44.54
	3	1994	62	56	140	0.2	118.1	-15.64
	4	1994	0	0	18	0.2	16.22	-9.89
	5	1994	0	0	12	0.2	14.13	17.75
	6	1994	0	0	16	0.2	16.49	3.06
	7	1994	0	0	39	0.4		
	8	1994	0	0	22	0.4		
	9	1994	0	0	27	0.4		
	10	1994	11	0	35	0.4		
	11	1994	38	33	76	0.4	28.7	-62.24
	12	1994	0	0	10	0.4	13.5	35
	1	1995	12	0	54	0.4		
	2	1995	68	30	84	0.4		
	3	1995	0	0	30	0.4		
	4	1995	0	0	0	0.5		
	4	1995	35	15	32	0.4		
	5	1995	22	14	50	0.4		
	6	1995	35	22	74	0.4		
	7	1995	19	13	38	0.4		
	8	1995	21	20	55	0.4		
	9	1995	23	16	118	0.4		
	10	1995	22	21	41	0.2		
	11	1995	11	11	24	0.2		
	12	1995	0	0	33	0.4		
	1	1996	242	105	33	0.2		
	2	1996	38	38	42	0.21		
	3	1996	34	29	55	0.4		
	4	1996	25	24	121	0.4		
	5	1996	47	46	163	0.4		
	Total (0.2NCF)		212	199	586		447.56	-75.76
	Average		63.94	28.43	83.71		63.94	-10.82
	Variance		1149.9	981.29	5085.57		2160.72	421.38
	Std Deviation		33.91	29.88	71.31		46.48	20.53
	Total (0.4NCF)		38	33	86		42.2	-27.24
	Average		19	19	43		21.1	-13.62
	Variance		722	544.5	2178		115.52	4727.8
	Std Deviation		26.87	23.33	46.67		10.75	68.76
	Overall Total		269	247	804		531.89	-171.08
	Average		23.1	21.4	77.9		61.21	-17.11
	Variance		927.21	798.93	4257.21		1911.29	1128.4
	Std Deviation		30.45	28.27	65.25		43.72	33.59

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP4		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	10	0.5		
		2	1994	0	0	26	0.5		
		3	1994	0	0	32	0.5		
		4	1994	10	0	22	0.5		
		5	1994	0	0	30	0.5		
		6	1994	0	0	32	0.5		
		7	1994	0	0	30	0.5		
		8	1994	0	0	43	0.5		
		9	1994	0	0	32	0.5		
		10	1994	0	0	19	0.5		
		11	1994	0	0	26	0.5		
		12	1994	0	0	32	0.5		
		1	1995	0	0	15	0.5		
		2	1995	0	0	14	0.5		
		3	1995	13	12	55	0.5		
		4	1995	15	15	68	0.5		
		5	1995	14	12	96	0.5		
		6	1995	18	14	68	0.5		
		7	1995	0	0	47	0.5		
		8	1995	41	41	155	0.5		
		9	1995	52	52	149	0.4	103.1	-30.8
		10	1995	28	26	120	0.4	81.9	-31.8
		11	1995	30	29	110	0.4	53.8	-51.1
		12	1995	38	38	52	0.2	129.3	148.7
		1	1996	71	69	92	0.4	146.8	59.57
		2	1996	56	56	49	0.21	118.1	141
		3	1996	24	24	50	0.2	113.3	126.6
		4	1996	33	30	22	0.4	94.63	330.1
		5	1996	14	14	47	0.5	196.1	317.2
		Total (0.4NCF)		214	206	493		480.23	275.97
		Average		42.8	41.2	98.6		96.05	-37.9
		Variance		339.7	348.7	2259.8		1153.14	25463
		Std Deviation		18.43	18.67	47.54		33.96	159.57
		Total (0.2NCF)		62	62	102		242.6	275.3
		Average		31	31	51		121.3	137.65
		Variance		98	98	2		128	244.21
		Std Deviation		9.9	9.9	1.41		11.31	15.63
		Overall Total		346	338	691		1037.03	1009.5
		Average		38.44	37.56	76.78		115.23	112.16
		Variance		321.03	317.53	1801.2		1650.32	20312
		Std Deviation		38.44	17.82	42.44		40.62	142.52

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP5	5	1993	0	0	0	0.4	1.66	
	6	1993	0	0	0	0.4	4.11	
	7	1993	0	0	0	0.4	0.27	
	8	1993	0	0	0	0.4	4.66	
	9	1993	0	0	0	0.4	1.18	
	10	1993	0	0	0	0.4	4.66	
	11	1993	0	0	0	0.4		
	12	1993	0	0	0	0.4		
	1	1994	0	0	0	0.4		
	2	1994	0	0	5	0.4		
	3	1994	0	0	8	0.4		
	4	1994	0	0	6	0.4		
	5	1994	0	0	6	0.4		
	6	1994	0	0	23	0.4		
	7	1994	0	0	34	0.4		
	8	1994	0	0	18	0.4		
	9	1994	0	0	17	0.4		
	10	1994	0	0	18	0.4		
	11	1994	15	15	79	0.4		
	12	1994	11	0	31	0.4		
	1	1995	21	11	49	0.4		
	2	1995	0	0	40	0.4		
	3	1995	13	12	73	0.4		
	4	1995	0	0	20	0.4		
	5	1995	17	0	58	0.4		
	6	1995	0	0	36	0.4		
	7	1995	25	20	57	0.4		
	8	1995	30	15	46	0.4		
	9	1995	0	0	30	0.4		
	10	1995	23	15	42	0.26		
	11	1995	0	0	23	0.25		
	12	1995	0	0	21	0.26		
	1	1996	10	0	28	0.23		
	2	1996	20	20	31	0.23		
	3	1996	18	16	76	0.22		
	4	1996	53	48	164	0.17		
	5	1996	96	88	252	0.19		
Total			0	0	0		16.54	
Average			0	0	0		2.38	
Variance			0	0	0		3.65	
Std Deviation			0	0	0		1.91	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP6		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	14	13	0	0.5		
		3	1994	0	0	0	0.5		
		4	1994	0	0	7	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	0	0	0	0.5		
		8	1994	0	0	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	12	0	5	0.5		
		1	1995	0	0	0	0.4		
		2	1995	15	13	65	0.5		
		3	1995	41	41	92	0.4	73.8	-19.78
		4	1995	23	21	76	0.4	88.4	16.32
		5	1995	43	42	134	0.4	84	-37.31
		6	1995	18	18	76	0.4	88.9	16.97
		7	1995	33	32	76	0.4	70.9	-6.71
		8	1995	77	73	139	0.4	152.5	9.71
		9	1995	50	50	163	0.4	131.8	-19.14
		10	1995	37	35	122	0.4	26.8	-78.03
		11	1995	29	23	143	0.4	80.4	-43.78
		12	1995	13	13	25	0.21	75.95	203.8
		Total (0.4NCF)		351	335	1021		798	-161.75
		Average		39.00	37.22	113.44		88.61	-17.97
		Variance		302.75	293.44	1143.03		1298.69	992.70
		Std Deviation		17.40	17.13	33.81		36.04	31.51
		Overall Total		364	348	1046		873	42.05
		Average		36.40	34.80	104.60		87.35	4.21
		Variance		336.71	319.51	1798.27		1170.42	5800.69
		Std Deviation		18.35	17.87	42.41		34.21	76.16

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP7	3	1993	0	0	0	0.5		
	5	1993	0	0	0	0.5		
	6	1993	0	0	0	0.4		
	7	1993	0	0	35	0.4	20.84	-40.5
	8	1993	36	32	145	0.4	72.31	-50.1
	9	1993	17	15	35	0.2	31.84	-9.03
	10	1993	0	0	22	0.2	4.08	-81.5
	11	1993	13	12	32	0.2	38.3	19.69
	12	1993	0	0	13	0.2	20.98	61.38
	1	1994	81	81	120	0.7		
	2	1994	22	21	37	0.7		
	3	1994	53	51	73	0.7		
	4	1994	0	0	31	0.7		
	5	1994	0	0	16	0.7		
	6	1994	14	0	36	0.7		
	7	1994	0	0	31	0.7		
	8	1994	33	33	47	0.7		
	9	1994	67	67	56	0.7		
	10	1994	38	38	43	0.7		
	11	1994	21	18	41	0.7		
	12	1994	0	0	19	0.7		
	1	1995	12	12	43	0.7		
	2	1995	12	12	40	0.7		
	3	1995	10	10	25	0.7		
	4	1995	17	16	33	0.7		
	5	1995	12	11	33	0.7		
	6	1995	44	44	52	0.7		
	7	1995	45	45	52	0.7		
	8	1995	68	64	64	0.7		
	9	1995	82	82	62	0.7		
	10	1995	53	41	24	0.24		
	11	1995	65	59	16	0.26		
	12	1995	15	14	3	0.28		
	1	1996	23	20	20	0.24		
	2	1996	52	51	25	0.3		
	3	1996	55	54	20	0.26		
	4	1996	71	71	3	0.23		
	5	1996	65	61	24	0.29		
Total (0.2NCF)			30	27	102		95.20	-9.46
Average			7.5	6.75	25.50		23.80	-2.37
Variance			77.67	62.25	100.33		223.91	3618.87
Std Deviation			8.81	7.89	10.02		14.96	60.16
Total (0.4NCF)			36	32	180		93.15	-90.6
Average			18	16	90		46.58	-45.30
Variance			648	512	6050		1324.58	46.08
Std Deviation			25.46	22.63	77.78		36.39	6.79
Overall Total			66	59	282		188.35	-100.06
Average			11	9.83	47		31.39	-16.68
Variance			205.60	162.57	2379.60		537.58	2672.12
Std Deviation			14.34	12.75	48.78		23.19	51.69

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP8		7	1994	0	0	0	0.5		
		8	1994	0	0	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	0	0	0	0.5		
		1	1995	0	0	0	0.5		
		2	1995	0	0	0	0.5		
		3	1995	15	15	35	0.5		
		4	1995	16	16	57	0.5		
		5	1995	0	0	36	0.5		
		6	1995	0	0	42	0.5		
		7	1995	0	0	36	0.5		
		8	1995	11	0	43	0.5		
		9	1995	0	0	32	0.5		
		10	1995	0	0	45	0.5		
		11	1995	0	0	27	0.5		
		12	1995	11	11	7	0.5		
		1	1996	93	91	352	0.2	159.8	-54.6
		2	1996	27	27	97	0.2	165.3	70.44
		3	1996	30	28	120	0.2	169.8	41.5
		4	1996	28	23	85	0.2	181.2	113.2
		5	1996	62	61	238	0.19	371.1	55.92
		Total (0.2NCF)		178	169	654		676.10	170.54
		Average		44.50	42.25	163.50		169.03	42.64
		Variance		1047.00	1060.92	16003.00		82.60	5,069.50
		Std Deviation		32.36	32.57	126.50		9.09	71.20
		Overall Total		240	230	892		1,047.20	226.46
		Overall		48.00	46.00	178.40		209.44	45.29
		Variance		846.50	866.00	13112.30		8,228.81	3,837.40
		Std Deviation		29.09	29.43	114.51		90.71	61.95

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP9	5	1993	0	0	0	0.5		
	6	1993	0	0	0	0.5		
	7	1993	0	0	0	0.5		
	8	1993	0	0	0	0.5		
	9	1993	0	0	0	0.5		
	11	1993	0	0	0	0.5		
	12	1993	0	0	0	0.5		
	1	1994	0	0	0	0.5		
	2	1994	0	0	0	0.5		
	3	1994	0	0	0	0.5		
	4	1994	0	0	0	0.5		
	5	1994	0	0	0	0.5		
	6	1994	0	0	0	0.5		
	7	1994	0	0	0	0.5		
	8	1994	0	0	0	0.5		
	9	1994	0	0	0	0.5		
	10	1994	0	0	0	0.5		
	11	1994	0	0	0	0.5		
	12	1994	0	0	0	0.5		
	1	1995	0	0	0	0.5		
	2	1995	0	0	0	0.5		
	3	1995	0	0	0	0.5		
	4	1995	0	0	0	0.5		
	5	1995	0	0	0	0.5		
	6	1995	0	0	0	0.5		
	7	1995	0	0	0	0.5		
	8	1995	0	0	0	0.5		
	9	1995	0	0	0	0.5		
	10	1995	0	0	0	0.5		
	11	1995	0	0	0	0.5		
	12	1995	0	0	0	0.5		
	1	1996	0	0	14	0.5	10	-28.6
	1	1996	39	34	124	0.2	126.5	2.02
	3	1996	45	44	107	0.2	146.9	37.29
	4	1996	29	26	93	0.2	170.9	83.76
	5	1996	70	65	151	0.19	276.2	82.91
Total (0.2NCF)			84	78	231		273.40	39.31
Average			37.67	34.67	108		148.10	41.02
Variance			65.33	81.33	241		493.92	1680.97
Std Deviation			8.08	9.02	15.52		22.22	41.00
Overall Total			183	169	489		730.50	177.38
Average			36.60	33.80	97.80		146.10	35.48
Variance			647.30	570.20	2661.70		9112.27	2452.48
Std Deviation			25.44	23.88	51.59		95.46	49.52

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP10	5	1993	0	0	0	0.2		
	6	1993	0	0	0	0.2		
	7	1993	18	0	12	0.2		
	8	1993	32	30	68	0.2	39.33	-42.16
	9	1993	12	11	29	0.2	22.56	-22.21
	10	1993	27	23	34	0.2	24.88	-26.82
	11	1993	10	0	31	0.2	24.09	-22.29
	12	1993	15	14	33	0.2	38.75	17.42
	1	1994	29	27	87	0.2	47.8	-45.06
	2	1994	78	76	123	0.2	91.4	-25.69
	3	1994	65	63	112	0.2	104.7	-6.52
	4	1994	23	0	12	0.2	10.13	-15.58
	5	1994	0	0	0	0.2		
	6	1994	0	0	7	0.2	2.82	-59.71
	7	1994	15	14	44	0.2	50.3	14.32
	8	1994	19	17	54	0.2	49	-9.26
	9	1994	35	34	78	0.2	66.1	-15.26
	10	1994	31	31	70	0.2	95.8	36.86
	11	1994	39	37	72	0.2	89.1	23.75
	12	1994	37	35	60	0.2	65.7	9.5
	1	1995	0	0	16	0.2		
	2	1995	28	26	72	0.2	40.3	-44.03
	3	1995	41	41	124	0.2	83.5	-32.66
	4	1995	39	38	96	0.2	47.1	-50.94
	5	1995	69	68	228	0.2		
	6	1995	43	43	173	0.2	45.7	-73.58
	7	1995	29	24	97	0.2	51.2	-47.22
	8	1995	21	21	102	0.2	44.6	-56.27
	9	1995	0	0	18	0.2	27.6	53.33
	10	1995	11	11	46	0.2	21.1	-54.13
	11	1995	0	0	42	0.2	27.9	-33.57
	12	1995	25	25	67	0.2	30.02	-55.19
	1	1996	21	21	108	0.22		
	2	1996	46	42	144	0.23	81.19	-43.62
	3	1996	25	21	84	0.2	108.7	29.4
	4	1996	19	18	57	0.19	146	156.1
	5	1996	39	34	119	0.19	129	8.4
Total (0.19NCF)			58	52	176		275	164.5
Average			29	26	88		137.50	82.25
Variance			200	128	1922		144.50	10907.65
Std Deviation			14.14	11.31	43.84		12.02	104.44
Total (0.2NCF)			729	662	1835		1241.48	-582.97
Average			27	24.52	67.96		50.01	-20.50
Variance			321.85	347.64	1510.81		842.29	1105.38
Std Deviation			17.94	18.65	38.87		29.02	33.25
Overall Total			833	756	2155		1706.37	-432.69
Average			27.77	25.20	71.83		56.88	-14.42
Variance			307.56	326.30	1632.35		1272.75	2075.50
Std Deviation			17.54	18.06	40.40		35.68	45.56

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP11	5	1993	0	0	0	0.4		
	6	1993	0	0	0	0.4		
	7	1993	0	0	0	0.4		
	8	1993	0	0	0	0.4	5.67	
	9	1993	0	0	0	0.4		
	10	1993	0	0	0	0.4	0.32	
	11	1993	0	0	0	0.4		
	12	1993	0	0	0	0.4	0.1	
	1	1994	0	0	20	0.4	9.2	-54
	2	1994	0	0	5	0.4		
	3	1994	0	11	0	0.4		
	4	1994	0	0	0	0.4		
	5	1994	0	0	0	0.4		
	6	1994	0	0	0	0.4		
	7	1994	0	0	0	0.4		
	8	1994	0	0	0	0.4		
	9	1994	0	0	0	0.4		
	10	1994	0	0	0	0.4		
	11	1994	0	0	0	0.4		
	12	1994	0	0	0	0.4		
	1	1995	0	0	0	0.4		
	2	1995	0	0	0	0.4		
	3	1995	0	0	0	0.4		
	4	1995	0	0	0	0.4		
	5	1995	0	0	0	0.4		
	6	1995	0	0	0	0.4		
	7	1995	0	0	0	0.4		
	8	1995	0	0	0	0.4		
	9	1995	0	0	0	0.2		
	10	1995	0	0	0	0.2		
	11	1995	0	0	0	0.4		
	12	1995	0	0	0	0.29		
	1	1996	0	0	0	0.26		
	2	1996	0	0	0	0.4		
	3	1996	0	0	0	1.05		
	4	1996	0	0	0	0.16		
	5	1996	0	0	0	0.53		
	Total		0	0	20		15.29	-54
	Average		0	0	5		3.82	-54
	Variance		0	0	100		19.49	
	Std Deviation		0	0	10		4.41	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP12		5	1993	0	0	0	0.2	15.01	
		6	1993	0	0	0	0.2		
		7	1993	10	0	16	0.2	27.9	74.38
		8	1993	21	20	40	0.2	41.18	2.95
		9	1993	0	0	25	0.2	13.02	-47.9
		10	1993	0	0	12	0.2	11.91	-0.75
		11	1993	0	0	0	0.2	6.54	
		12	1993	13	0	27	0.2	24.2	-10.4
		1	1994	0	0	33	0.2	19.7	-40.3
		2	1994	20	19	51	0.2	38.2	-25.1
		3	1994	17	15	49	0.2	30.2	-38.4
		4	1994	0	0	23	0.2	11.78	-48.8
		5	1994	0	0	9	0.2		
		6	1994	0	0	12	0.2	13.73	14.42
		7	1994	0	0	26	0.2		
		8	1994	0	0	33	0.2		
		9	1994	0	0	32	0.2		
		10	1994	43	0	21	0.2		
		11	1994	14	12	49	0.2		
		12	1994	33	0	26	0.2		
		1	1995	13	0	42	0.2		
		2	1995	13	13	52	0.2		
		3	1995	0	0	30	0.2		
		4	1995	0	0	25	0.2		
		5	1995	12	11	55	0.2		
		6	1995	19	17	58	0.2		
		7	1995	0	0	44	0.2		
		8	1995	18	16	65	0.2		
		9	1995	0	0	11	0.2		
		Total		81	54	288		253.57	-119.9
		Average		6.75	4.5	24		21.11	-11.99
		Variance		77.48	67.55	291.45		125.11	1425.06
		Std Deviation		8.8	8.22	17.07		11.19	37.75

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP13	5	1993	17	12	14	0.7		
	6	1993	23	13	13	0.7		
	7	1993	20	19	29	0.7		
	8	1993	0	0	14	0.7		
	9	1993	0	0	0	0.7		
	10	1993	0	0	11	0.7		
	11	1993	0	0	0	0.7		
	12	1993	0	0	15	0.7		
	1	1994	0	0	15	0.7	0.9	-94
	2	1994	16	16	111	0.7	48.9	-55.95
	3	1994	41	39	126	0.4	75	-40.48
	4	1994	13	14	36	0.4	28.42	-21.06
	5	1994	0	0	11	0.4	4.43	-59.73
	6	1994	12	12	53	0.4	37.64	-28.98
	7	1994	19	18	26	0.4	59.8	130
	8	1994	42	41	90	0.4	111.7	24.11
	9	1994	15	14	94	0.4	49.4	-47.45
	10	1994	11	10	49	0.4	54.5	11.22
	11	1994	70	69	218	0.4	182.5	-16.67
	12	1994	142	109	154	0.4	164.1	6.56
	1	1995	43	43	176	0.4	147.7	-16.08
	2	1995	53	48	75	0.2	162.3	116.4
	3	1995	70	58	94	0.2	138.8	47.66
	4	1995	70	67	113	0.2	164.7	45.75
	5	1995	92	84	179	0.2	109.6	-38.77
	6	1995	165	159	260	0.2	184.5	-29.04
	7	1995	62	62	144	0.2	153.3	6.46
	8	1995	0	0	3	0.2		
	9	1995	0	0	0	0.2		
	10	1995	11	10	38	0.2		
	11	1995	23	22	77	0.2		
	12	1995	10	10	26	0.21		
	1	1996	140	140	441	0.22		
	2	1996	80	67	211	0.2		
	3	1996	13	12	50	0.2	52.9	5.8
	4	1996	0	0	15	0.19	73.04	386.9
	5	1996	93	56	176	0.19	197.5	12.22
	Total (0.19NCF)		93	56	191		270.54	399.12
	Average		46.5	28	95.5		135.27	199.56
	Variance		4324.5	1568	12960.5		7745.15	70192.55
	Std Deviation		65.76	39.6	113.84		88.01	264.94
	Total (0.20NCF)		525	490	915		966.1	154.26
	Average		75	70	130.71		138.01	22.04
	Variance		2156	2030.33	5083.9		1958.15	2822.64
	Std Deviation		46.43	45.06	71.3		44.25	53.13
	Total (0.40NCF)		408	369	1034		915.19	-58.56
	Average		37.09	33.55	94		83.2	-5.32
	Variance		1624.49	1027.47	4557.2		3524	2661.6
	Std Deviation		40.3	32.05	67.51		59.36	51.59
	Total (0.70NCF)		16	16	126		49.8	-149.95
	Average		8	8	63		24.9	-74.98
	Variance		128	128	4608		1152	723.9
	Std Deviation		11.31	11.31	67.88		33.94	26.91
	Overall Total		1042	931	2266		2201.63	344.87
	Average		47.36	42.32	103		100.07	15.68
	Variance		2059.1	1577.56	4915.43		3946.4	9698.31
	Std Deviation		45.38	39.72	70.11		62.82	98.48

Employee Monthly and TLD Bubble Dosimetry Results

				Dose	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP14		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	27	24	85	0.5		
		3	1994	0	0	0	0.5		
		4	1994	0	0	0	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	0	0	0	0.5		
		8	1994	0	0	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	0	0	0	0.5		
		1	1995	0	0	8	0.5		
		2	1995	0	0	0	0.4		
		3	1995	27	27	98	0.4		
		4	1995	35	34	96	0.4	141.9	47.81
		5	1995	26	26	105	0.4	69.6	-33.7
		6	1995	67	65	114	0.4	128.7	12.89
		7	1995	69	69	142	0.4	136.6	-3.8
		8	1995	59	59	92	0.4	128.3	39.46
		9	1995	39	38	84	0.4	72.1	-14.17
		10	1995	46	46	133	0.4	63.8	-52.03
		11	1995	47	46	147	0.4	69.5	-52.72
		12	1995	17	16	27	0.21	95.26	252.81
		1	1996	24	23	48	0.23	79.57	65.77
		2	1996	37	35	44	0.21	123.1	179.77
		3	1996	44	37	56	0.23	128.4	129.29
		4	1996	37	33	85	0.19	181.8	113.88
		5	1996	32	32	62	0.21	135.4	118.39
		Total (0.21NCF)		86	83	133		353.76	550.97
		Average		28.67	27.67	44.33		117.92	183.66
		Variance		108.33	104.33	306.33		422.93	4528.5
		Std Deviation		10.41	10.21	17.5		20.57	67.29
		Total (0.23NCF)		68	60	104		207.97	195.06
		Average		34	30	52		103.99	97.53
		Variance		200	98	32		1192.2	2017.4
		Std Deviation		14.14	9.9	5.66		34.53	44.92
		Total (0.40NCF)		388	383	913		810.5	-56.26
		Average		48.5	47.88	114.13		101.31	-7.03
		Variance		237.14	234.13	574.5		1235.6	1493
		Std Deviation		15.4	15.3	23.97		35.15	38.64
		Overall Total		579	559	1235		1554	803.65
		Average		41.36	39.93	88.21		111	57.4
		Variance		238.09	242.07	1419.1		1284.1	8382.9
		Std Deviation		15.43	15.56	37.67		35.83	91.56

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP15		5	1993	11	0	29	0.4	13.62	-53.03
		6	1993	17	17	12	0.4	20.77	73.08
		7	1993	10	10	23	0.4		
		8	1993	19	19	50	0.4		
		9	1993	16	17	41	0.4		
		10	1993	0	0	19	0.4		
		11	1995	0	0	0	0.5		
		12	1995	0	0	0	0.5		
		1	1996	0	0	0	0.5		
		2	1996	0	0	0	0.5		
		3	1996	0	0	0	0.5		
		5	1996	11	11	0	0.5		
		Total		28	17	41		34.39	20.05
		Average		14	8.5	20.5		17.2	10.03
		Variance		18	144.5	144.5		25.56	7951.87
		Std Deviation		4.24	12.02	12.02		5.06	89.17

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP16		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	0	0	0	0.5		
		8	1994	0	0	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	0	0	0	0.5		
		1	1995	0	0	0	0.5		
		2	1995	0	0	0	0.5		
		3	1995	0	0	0	0.5		
		4	1995	0	0	0	0.5		
		5	1995	0	0	0	0.5		
		6	1995	0	0	8	0.5		
		7	1995	5	3	13	0.5		
		8	1995	13	0	27	0.5		
		9	1995	0	0	41	0.5		
		10	1995	31	31	36	0.5		
		11	1995	11	0	19	0.5		
		12	1995	0	0	15	0.5		
		1	1996	95	95	351	0.2	245.4	-30.08
		2	1996	91	85	313	0.2	285.9	-8.65
		3	1996	29	29	108	0.2	150.4	39.3
		4	1996	0	0	17	0.2	22.59	32.88
		5	1996	95	95	256	0.2	363.8	42.13
		Total		310	304	1045		1068.09	75.58
		Average		62	60.8	209		213.62	15.12
		Variance		1988	1908.2	20063.5		17319.41	1059.36
		Std Deviation		44.59	43.68	141.65		131.6	32.55

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP17	5	1993	0	0	0	0.5		
	6	1993	0	0	0	0.5		
	7	1993	0	0	0	0.5		
	8	1993	0	0	0	0.5		
	9	1993	0	0	0	0.5		
	10	1993	0	0	0	0.5		
	11	1993	12	0	0	0.5		
	12	1993	0	0	0	0.5		
	1	1994	0	0	0	0.5		
	2	1994	0	0	0	0.5		
	3	1994	0	0	0	0.5		
	4	1994	0	0	0	0.5		
	5	1994	0	0	0	0.5		
	6	1994	0	0	0	0.5		
	7	1994	0	0	0	0.5		
	8	1994	0	0	0	0.5		
	9	1994	0	0	0	0.5		
	10	1994	0	0	0	0.5		
	11	1994	0	0	0	0.5		
	12	1994	0	0	0	0.5		
	1	1995	0	0	0	0.4		
	2	1995	0	0	0	0.4		
	3	1995	38	38	102	0.4	108.2	6.08
	4	1995	51	47	120	0.4	108.3	-9.75
	5	1995	34	33	108	0.4	83	-23.1
	6	1995	33	33	80	0.5	106.5	33.13
	7	1995	61	58	143	0.4	118	-17.5
	8	1995	32	31	80	0.4	100.4	25.5
	9	1995	21	21	59	0.4	41.9	-29
	10	1995	81	15	112	0.4	68.8	-38.6
	11	1995	51	49	116	0.4	74.8	-35.5
	12	1995	20	20	42	0.25	92.16	119.4
	1	1996	21	19	38	0.25	55.64	46.42
	2	1996	42	42	60	0.28	106.6	77.67
	3	1996	25	25	65	0.23	113.6	74.77
	4	1996	44	37	69	0.25	118.7	72.03
	5	1996	33	33	53	0.22	90.56	70.87
	Total (0.25NCF)		85	76	149		266.5	237.9
	Average		28.33	25.33	49.67		88.83	79.26
	Variance		184.33	102.33	284.33		1002.4	1371
	Std Deviation		13.58	10.12	16.86		31.66	37.03
	Total (0.40NCF)		369	292	840		703.4	-122
	Average		46.13	36.5	105		87.93	-15.2
	Variance		361.27	210.86	656.86		652.42	479.5
	Std Deviation		19.01	14.52	25.63		25.54	21.9
	Overall Total		587	501	1247		1387.2	372.4
	Average		39.13	33.4	83.13		92.48	24.83
	Variance		280.12	149.83	1009.6		544.53	2522
	Std Deviation		16.74	12.24	31.77		23.34	50.22

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Buble Dose (mrem)	% Diff.
EMP18	8	1993	0	0	0	0.5		
	9	1993	0	0	0	0.5		
	10	1993	0	0	0	0.5		
	10	1993	12	12	21	0.4	13.88	-33.9
	11	1993	24	17	38	0.4	40.1	5.53
	12	1993	18	23	39	0.4	52.74	35.23
	1	1994	30	20	54	0.4	52.8	-2.22
	2	1994	26	26	57	0.4	54.3	-4.74
	3	1994	49	48	123	0.4	72.4	-41.14
	4	1994	11	11	33	0.4	28.98	-12.18
	5	1994	0	0	14	0.4	10.02	-28.43
	6	1994	24	22	52	0.4	44.39	-14.63
	7	1994	37	37	85	0.4	75.6	-11.06
	8	1994	35	33	74	0.4	78.6	6.22
	9	1994	37	37	85	0.4	64.3	-24.35
	10	1994	21	18	60	0.4	79.6	32.67
	11	1994	40	39	115	0.4	136.4	18.61
	12	1994	31	28	85	0.4	101.9	19.88
	1	1995	42	41	116	0.4	110.4	-4.83
	2	1995	32	29	96	0.4	124.9	30.1
	3	1995	55	54	155	0.4	120.7	-22.13
	4	1995	49	47	153	0.4	141.1	-7.78
	5	1995	10	10	84	0.4	39.8	-52.62
	6	1995	30	30	111	0.4	83.6	-24.68
	7	1995	30	30	104	0.4	82.2	-20.96
	8	1995	40	40	118	0.4	87.7	-25.68
	9	1995	16	16	46	0.4	38.8	-15.65
	10	1995	33	33	28	0.22	72	157.1
	11	1995	27	25	44	0.2	36.8	-16.36
	12	1995	17	16	27	0.21	71.88	166.2
	1	1996	40	39	69	0.21	130.87	89.67
	2	1996	39	37	59	0.23	111.84	89.56
	3	1996	20	20	37	0.2	59.12	59.78
	4	1996	55	52	74	0.19	175.92	137.7
	5	1996	68	68	114	0.2	151.96	33.3
	Total (0.20NCF)		115	113	195		247.88	76.72
	Average		38.33	37.67	65		82.63	25.57
	Variance		672.33	696.33	1813		3729.88	1494.1
	Std Deviation		25.93	26.39	42.58		61.07	38.65
	Total (0.21NCF)		57	55	96		202.75	255.87
	Average		28.5	27.5	48		101.38	127.94
	Variance		264.5	264.5	882		1739.91	2928.42
	Std Deviation		16.26	16.26	29.7		41.71	54.11
	Total (0.4NCF)		699	668	1918		1735.21	-198.74
	Average		29.13	27.83	79.92		72.3	-8.28
	Variance		186.72	183.19	1553.21		1354.76	540.43
	Std Deviation		13.66	13.53	39.41		36.81	23.25
	Overall Total		998	958	2370		2545.6	518.21
	Average		31.19	29.94	74.06		79.55	16.19
	Variance		219.51	216.58	1451.87		1709.3	3159.99
	Std Deviation		14.82	14.72	38.1		41.34	56.21

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP19		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	0	0	0	0.5		
		3	1994	0	0	0	0.5		
		4	1994	0	0	0	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	0	0	0	0.5		
		8	1994	0	0	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	0	0	0	0.5		
		1	1995	0	0	0	0.5		
		2	1995	0	0	0	0.5		
		3	1995	0	0	0	0.5		
		4	1995	0	0	0	0.5		
		5	1995	0	0	0	0.5		
		6	1995	0	0	0	0.5		
		7	1995	0	0	0	0.5		
		8	1995	0	0	0	0.5		
		9	1995	0	0	0	0.4		
		10	1995	35	35	103	0.4	70.7	-31.36
		11	1995	37	35	45	0.24	61.2	36
		12	1995	18	18	30	0.25	71.88	139.6
		1	1996	33	30	64	0.24	117.2	83.13
		2	1996	50	48	62	0.22	136.5	120.2
		3	1996	37	36	67	0.22	138.9	107.3
		4	1996	23	22	48	0.25	92.83	93.4
		5	1996	19	19	42	0.26	67.55	60.83
		Total (0.22NCF)		87	84	129		275.4	227.5
		Average		43.5	42	64.5		137.7	113.8
		Variance		84.5	72	12.5		2.88	83.21
		Std Deviation		9.19	8.49	3.54		1.7	9.12
		Total (0.24NCF)		70	65	109		178.4	119.1
		Average		35	32.5	54.5		89.2	59.57
		Variance		8	12.5	180.5		1568	1111
		Std Deviation		2.83	3.54	13.44		39.6	33.33
		Total (0.25NCF)		51	48	94		164.71	233
		Average		25.5	24	47		82.36	116.5
		Variance		112.5	72	578		219.45	1067
		Std Deviation		10.61	8.49	24.04		14.81	32.67
		Overall Total		252	243	461		756.76	609.1
		Average		31.5	30.38	57.63		94.6	76.14
		Variance		118.29	105.41	495.13		1023.8	2955
		Std Deviation		10.88	10.27	22.25		32	54.36

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP20		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	0	0	20	0.5	8.9	-55.5
		3	1994	0	0	0	0.5	0.4	
		4	1994	0	0	3	0.2	2.27	-24.3
		5	1994	0	0	8	0.2	9.93	24.13
		6	1994	0	0	5	0.2	6.5	30
		7	1994	13	11	29	0.2	51.2	76.55
		8	1994	23	23	45	0.2	87.8	95.11
		9	1994	44	18	50	0.2	56.1	12.2
		10	1994	27	26	51	0.2	115.2	125.9
		11	1994	35	31	63	0.2	83.1	31.9
		12	1994	0	0	12	0.2	20.6	71.67
		1	1995	20	19	48	0.2	57	18.75
		2	1995	62	62	80	0.2	119.3	49.13
		3	1995	27	27	44	0.2	49.3	12.05
		4	1995	34	32	50	0.2	60.4	20.8
		5	1995	46	44	73	0.2	99.1	35.75
		6	1995	44	44	82	0.2	93.5	14.02
		7	1995	26	26	46	0.2	49.2	6.96
		8	1995	60	46	92	0.2	150.4	63.48
		9	1995	42	10	46	0.2	51.3	11.52
		10	1995	25	25	57	0.2	43.5	-23.7
		11	1995	33	33	106	0.2	76.3	-28
		12	1995	48	48	78	0.2	135.7	73.97
		1	1996	41	40	105	0.2	126.5	20.43
		2	1996	68	66	140	0.2	156.6	11.83
		3	1996	85	35	193	0.2	260.1	34.78
		4	1996	18	16	68	0.2	119.8	76.24
		5	1996	87	85	195	0.2	293.8	50.66
		Total (0.2NCF)		908	767	1769		2374.5	891.8
		Average		34.92	29.5	68.04		91.33	34.3
		Variance		581.59	455.46	2432		4885.7	1381
		Std Deviation		24.12	21.34	49.31		69.9	37.17
		Overall Total		908	767	1789		2383.8	836.3
		Average		32.43	27.39	63.89		85.14	30.98
		Variance		622.4	481.58	2490.9		5041.8	1627
		Std Deviation		24.95	21.94	49.91		71.01	40.33

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP21		5	1993	0	0	0	0.5		
		6	1993	10	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	0	0	0	0.5		
		3	1994	0	0	0	0.5		
		4	1994	0	0	0	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	12	0	23	0.2	24.8	7.83
		8	1994	27	23	57	0.2	85.9	50.7
		9	1994	50	45	92	0.2	88.1	-4.24
		10	1994	37	34	54	0.2	83.9	55.37
		11	1994	77	67	116	0.2	108.4	-6.55
		12	1994	75	67	102	0.2	135.5	32.84
		1	1995	71	66	173	0.2	153.5	-11.3
		2	1995	65	65	126	0.2	136.7	8.49
		3	1995	50	48	90	0.2	79.3	-11.9
		4	1995	46	44	100	0.2	109.7	9.7
		5	1995	43	41	119	0.2	93.2	-21.7
		6	1995	60	69	97	0.2	111.3	14.74
		7	1995	36	35	86	0.2	60.5	-29.7
		8	1995	63	57	164	0.2	109.8	-33
		9	1995	33	27	88	0.2	52.7	-40.1
		10	1995	81	79	162	0.2	66.4	-59
		11	1995	34	32	98	0.21	36	-63.3
		12	1995	17	17	43	0.2	66	53.49
		1	1996	0	0	5	0.2		
		2	1996	0	0	0	0.21		
		3	1996	0	0	6	0.2		
		4	1996	0	0	9	0.26		
		5	1996	0	0	9	0.2		
		Total (0.2NCF)		843	784	1692		1565.7	15.67
		Average		49.59	46.12	99.53		92.1	0.92
		Variance		439.26	470.49	1763.6		1100.5	1116.7
		Std Deviation		20.96	21.69	42		33.17	33.42
		Overall Total		877	816	1790		1601.7	-47.63
		Average		48.72	45.33	99.44		88.98	-2.65
		Variance		426.92	453.88	1660		1210.7	1280.2
		Std Deviation		20.66	21.3	40.74		34.79	35.78

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP22		5	1993	0	0	0	0.2	2.52	
		6	1993	0	0	0	0.2		
		7	1993	0	0	0	0.2		
		8	1993	0	0	0	0.2		
		9	1993	18	0	13	0.2		
		10	1993	20	20	22	0.2	9.27	-57.86
		11	1993	0	0	0	0.2	10.12	
		12	1993	0	0	0	0.2		
		1	1994	0	0	0	0.2		
		2	1994	48	45	86	0.2		
		3	1994	41	41	60	0.2		
		4	1994	37	37	69	0.2		
		5	1994	0	0	5	0.2		
		6	1994	0	0	3	0.2		
		7	1994	19	17	37	0.2		
		8	1994	23	22	40	0.2		
		9	1994	36	35	74	0.2		
		10	1994	31	31	57	0.2		
		11	1994	28	25	56	0.2		
		12	1994	24	13	34	0.2		
		1	1995	17	16	40	0.2		
		2	1995	0	0	20	0.2		
		3	1995	0	0	23	0.2		
		4	1995	0	0	19	0.2		
		5	1995	0	0	3	0.2		
		6	1995	0	0	0	0.2		
		7	1995	0	0	10	0.7		
		8	1995	0	0	20	0.7		
		9	1995	0	0	21	0.7		
		10	1995	0	0	30	0.7		
		11	1995	0	0	10	0.7		
		12	1995	0	0	0	0.57		
		1	1996	0	0	0	0.7		
		2	1996	0	0	0	0.61		
		3	1996	0	0	0	0.32		
		4	1996	0	0	0	0.7		
		5	1996	0	0	5	0.22		
		Total		20	20	22		21.91	
		Overall average		6.67	6.67	7.33		7.3	
		Variance		133.33	133.33	161.33		17.34	
		Stdev Deviation		11.55	11.55	12.7		4.16	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP23		5	1993	0	0	0	0.7		
		6	1993	0	0	0	0.7		
		7	1993	0	0	0	0.7		
		8	1993	0	0	0	0.7		
		9	1993	0	0	0	0.7		
		10	1993	0	0	0	0.7		
		11	1993	0	0	0	0.7		
		12	1993	0	0	0	0.7		
		1	1994	0	0	0	0.7		
		2	1994	0	0	0	0.7		
		3	1994	0	0	0	0.7		
		4	1994	0	0	0	0.7		
		5	1994	0	0	0	0.7		
		6	1994	0	0	0	0.7		
		7	1994	0	0	8	0.2		
		8	1994	0	0	23	0.4	22.3	-3.04
		9	1994	0	0	39	0.4	23.5	-39.74
		10	1994	49	0	63	0.4	39.6	-37.14
		11	1994	36	14	83	0.4	38.7	-53.37
		12	1994	0	0	42	0.4	46.8	11.43
		1	1995	0	0	16	0.2		
		2	1995	0	0	21	0.2		
		3	1995	0	0	14	0.2		
		4	1995	0	0	12	0.2		
		5	1995	0	0	6	0.2		
		6	1995	0	0	0	0.2		
		7	1995	0	0	3	0.2		
		8	1995	0	0	17	0.2		
		9	1995	0	0	0	0.2		
		10	1995	0	0	13	0.24		
		11	1995	0	0	14	0.23		
		12	1995	0	0	7	0.2		
		1	1996	0	0	56	0.21		
		2	1996	13	12	81	0.22		
		3	1996	0	0	30	0.2		
		4	1996	12	11	70	0.21		
		5	1996	16	15	82	0.18		
		Total		85	14	250		170.9	-121.86
		Average		17	2.8	50		34.18	-24.37
		Variance		563	39.2	543		116.07	744.23
		Std Deviation		23.73	6.26	23.3		10.77	27.28

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)		Bubble Dose (mrem)	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP24		5	1993	11	0	13	0.2	21.04	61.85
		6	1993	0	0	0	0.2		
		7	1993	0	0	0	0.2	7.26	
		8	1993	0	0	0	0.4		
		9	1993	0	0	0	0.4		
		10	1993	0	0	0	0.4		
		11	1993	0	0	0	0.4		
		12	1993	0	0	0	0.4		
		1	1994	0	0	0	0.4		
		2	1994	0	0	26	0.4		
		3	1994	0	0	19	0.4		
		4	1994	0	0	17	0.4		
		5	1994	0	0	7	0.4		
		6	1994	0	0	14	0.4		
		7	1994	0	0	22	0.4		
		8	1994	18	0	20	0.4		
		9	1994	0	0	23	0.4		
		10	1994	0	0	32	0.4		
		11	1994	0	0	25	0.4		
		12	1994	0	0	19	0.4		
		1	1995	0	0	33	0.4		
		2	1995	0	0	20	0.4		
		3	1995	0	0	41	0.4		
		4	1995	0	0	13	0.4		
		5	1995	0	0	14	0.4		
		6	1995	0	0	16	0.4		
		7	1995	0	0	0	0.4		
		8	1995	0	0	5	0.4		
		9	1995	0	0	0	0.4		
		10	1995	0	0	4	0.23		
		11	1995	0	0	0	0.4		
		12	1995	0	0	0	0.4		
		1	1996	0	0	6	0.4		
		2	1996	0	0	5	0.27		
		3	1996	0	0	21	0.28		
		4	1996	0	0	6	0.18		
		5	1996	0	0	28	0.21		
		Total		11	0	13		28.3	
		Average		5.5	0	6.5		14.15	
		Variance		60.5	0	84.5		94.94	
		Std Deviation		7.78	0	9.19		9.74	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Name		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP25		5	1993	0	0	0	0.2	12.86	
		6	1993	0	0	0	0.2	5.17	
		7	1993	0	0	0	0.2	4.89	
		8	1993	0	0	10	0.2	8.71	-12.9
		9	1993	0	0	11	0.2	10.41	-5.36
		10	1993	0	0	0	0.2	6.09	
		11	1993	0	0	0	0.2	11.59	
		12	1993	0	0	0	0.2	6.85	
		1	1994	0	0	13	0.2		
		2	1994	0	0	19	0.2		
		3	1994	0	0	15	0.2		
		4	1994	0	0	7	0.2		
		5	1994	0	0	0	0.2		
		6	1994	0	0	0	0.2		
		7	1994	0	0	14	0.2		
		8	1994	0	0	50	0.4		
		9	1994	0	0	22	0.4		
		10	1994	0	0	28	0.4		
		11	1994	13	0	38	0.4		
		12	1994	0	0	15	0.4		
		1	1995	0	0	28	0.4		
		2	1995	0	0	47	0.4		
		3	1995	16	16	97	0.4		
		4	1995	0	0	19	0.4		
		5	1995	0	0	42	0.4		
		6	1995	0	0	24	0.4		
		7	1995	11	11	39	0.4		
		8	1995	0	0	46	0.4		
		9	1995	0	0	41	0.4		
		10	1995	0	0	13	0.24		
		11	1995	0	0	10	0.27		
		12	1995	0	0	6	0.22		
		1	1996	0	0	6	0.27		
		2	1996	0	0	0	0.4		
		3	1996	0	0	0	0.4		
		4	1996	0	0	0	0.32		
		5	1996	0	0	0	0.21		
		Total		0	0	21		66.57	
		Average		0	0	2.63		8.32	
		Variance		0	0	23.7		9.24	
		Std Deviation		0	0	4.87		3.04	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP26		5	1993	0	0	20	0.7		
		6	1993	0	0	0	0.7		
		7	1993	0	0	21	0.7		
		8	1993	0	0	23	0.7		
		9	1993	0	0	11	0.7		
		10	1993	0	0	0	0.7		
		11	1993	0	0	16	0.7		
		12	1993	0	0	14	0.7		
		1	1994	0	0	152	0.7		
		2	1994	0	0	70	0.7		
		3	1994	0	0	24	0.7		
		4	1994	0	0	0	0.7		
		5	1994	0	0	0	0.7		
		6	1994	0	0	8	0.7		
		7	1994	33	32	82	0.4	66.8	-18.54
		8	1994	41	39	97	0.4	129	32.99
		9	1994	15	14	50	0.4	29.5	-41
		10	1994	21	21	55	0.4	103.1	87.45
		11	1994	38	36	77	0.4	126.9	64.81
		12	1994	12	0	24	0.4	24.8	3.33
		1	1995	27	26	69	0.4	89.1	29.13
		2	1995	23	23	63	0.4	87.2	38.41
		3	1995	30	22	67	0.4	82.3	22.84
		4	1995	27	26	68	0.4	92.9	36.62
		5	1995	17	17	53	0.4	54.8	3.4
		6	1995	27	27	82	0.4	89.8	9.51
		7	1995	43	41	90	0.4	90.6	0.67
		8	1995	40	40	120	0.4	124.3	3.58
		9	1995	33	30	72	0.4	67.9	-5.69
		10	1995	46	46	57	0.23	92.6	62.46
		11	1995	51	49	55	0.21	65	18.18
		12	1995	17	17	27	0.23	74.54	176.1
		1	1996	36	32	69	0.26	118.7	72.03
		2	1996	50	21	85	0.28	105.8	24.47
		3	1996	36	36	50	0.26	155.5	211
		4	1996	0	0	11	0.22	22.42	103.8
		5	1996	0	0	5	0.18		
		Total (0.23NCF)		63	63	84		167.14	238.56
		Average		31.5	31.5	42		83.57	119.28
		Variance		420.5	420.5	450		163.08	6457
		Std Deviation		20.51	20.51	21.21		12.77	80.36
		Total (0.26NCF)		72	68	119		274.2	283.03
		Average		36	34	59.5		137.1	141.52
		Variance		0	8	180.5		677.12	9656.3
		Std Deviation		0	2.83	13.44		26.02	98.27
		Total (0.40NCF)		427	394	1069		1259	267.51
		Average		28.47	26.27	71.27		83.93	17.83
		Variance		93.7	120.92	502.78		995.17	1038.3
		Std Deviation		9.68	11	22.42		31.55	32.22
		Overall Total		663	595	1423		1893.6	935.55
		Average		30.14	27.05	64.68		86.07	42.53
		Variance		170.69	167.47	609.08		1187.9	3611.8
		Std Deviation		13.07	12.94	24.68		34.47	60.1

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP27		5	1993	32	17	27	0.7		
		6	1993	17	11	20	0.7		
		7	1993	0	0	13	0.7		
		8	1993	11	0	50	0.7		
		9	1993	0	0	17	0.7		
		10	1993	0	0	21	0.7		
		11	1993	0	0	18	0.7		
		12	1993	18	18	24	0.7		
		1	1994	0	0	49	0.7		
		2	1994	15	13	36	0.7		
		3	1994	20	19	28	0.7		
		4	1994	0	0	10	0.7		
		5	1994	0	0	11	0.7		
		6	1994	0	0	14	0.7		
		7	1994	0	0	11	0.2	9.3	-15.45
		8	1994	26	24	77	0.2	98.9	28.44
		9	1994	51	44	97	0.2	86.6	-10.72
		10	1994	49	47	96	0.2	123.9	29.06
		11	1994	74	63	134	0.2	147.2	9.851
		12	1994	70	63	127	0.2	121.1	-4.646
		1	1995	71	63	172	0.2	199.8	16.16
		2	1995	51	48	101	0.2	176.2	74.46
		3	1995	78	73	152	0.2	167.7	10.33
		4	1995	43	42	93	0.2	93.8	0.86
		5	1995	47	43	155	0.2	145.7	-6
		6	1995	66	66	133	0.2	149.1	12.11
		7	1995	51	50	87	0.2	99.7	14.6
		8	1995	31	31	126	0.2	137.6	9.206
		9	1995	28	28	79	0.2	86.9	10
		10	1995	36	36	96	0.2	97	1.042
		11	1995	32	26	110	0.2	73.7	-33
		12	1995	19	19	81	0.2	93.25	15.12
		1	1996	14	13	83	0.2	99.81	20.25
		2	1996	26	25	119	0.2	122.2	2.689
		3	1996	23	23	109	0.3	134.6	23.49
		4	1996	24	24	105	0.2	140.6	33.9
		5	1996	37	35	164	0.2	171.5	4.573
		Total (0.2NCF)		924	863	2398		2641.56	222.84
		Average		42	39.23	109		120.07	10.13
		Variance		439.52	359.52	1293.52		1774.37	441.34
		Std Deviation		20.96	18.96	35.97		42.12	21.01
		Overall Total		947	851	2343		2604.66	241.75
		Average		41.17	38.52	106.5		118.39	10.99
		Variance		435.24	370.89	1142.93		1655.52	447.59
		Std Deviation		20.86	19.26	33.81		40.69	21.16

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP28		5	1993	0	0	0	0.4	1.93	
		6	1993	0	0	0	0.4	1.51	
		7	1993	0	0	0	0.4	4.6	
		8	1993	0	0	0	0.4	4.55	
		9	1993	0	0	0	0.4	2.43	
		10	1993	0	0	0	0.4	2.91	
		11	1993	0	0	0	0.4	12.97	
		12	1993	0	0	0	0.4	0.51	
		1	1994	0	0	0	0.4	0.5	
		2	1994	0	0	5	0.4	3.9	-22
		3	1994	0	0	10	0.4	1.7	-83
		4	1994	0	0	0	0.4	0.5	
		5	1994	0	0	0	0.4		
		6	1994	0	0	4	0.4	2.52	-37
		7	1994	16	15	35	0.4	29.4	-16
		8	1994	0	0	19	0.4	15	-21.1
		9	1994	0	0	15	0.4	8.1	-46
		10	1994	12	11	25	0.4		
		11	1994	10	0	31	0.4	31.5	1.613
		12	1994	11	0	21	0.4		
		1	1995	48	0	33	0.4		
		2	1995	0	0	25	0.4		
		3	1995	0	0	45	0.4		
		4	1995	0	0	18	0.4		
		5	1995	0	0	24	0.4		
		6	1995	21	20	69	0.4		
		7	1995	0	0	20	0.4		
		8	1995	19	18	50	0.4		
		9	1995	24	16	51	0.4		
		10	1995	79	75	44	0.3		
		11	1995	43	43	84	0.4		
		12	1995	0	0	20	0.2		
		1	1996	0	0	18	0.2		
		2	1996	41	33	53	0.2		
		3	1996	0	0	64	0.4		
		4	1996	29	27	78	0.2		
		5	1996	45	42	103	0.2		
		Total		26	15	119		124.53	
		Average		1.53	0.88	7		7.33	
		Variance		19.76	13.24	130		93.17	
		Std Deviation		4.45	3.64	11.4		9.65	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP29		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	21	0.5		
		8	1993	0	0	15	0.5		
		9	1993	0	0	18	0.5		
		10	1993	0	0	22	0.5		
		11	1993	0	0	18	0.5		
		12	1993	0	0	16	0.5		
		1	1994	0	0	25	0.5		
		2	1994	0	0	18	0.5		
		3	1994	0	0	31	0.5		
		4	1994	0	0	13	0.5		
		5	1994	0	0	15	0.5		
		6	1994	0	0	8	0.5		
		7	1994	0	0	12	0.5		
		8	1994	0	0	18	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	39	0.5		
		11	1994	14	0	59	0.5		
		12	1994	0	0	14	0.5		
		1	1995	0	0	25	0.5		
		2	1995	0	0	16	0.5		
		3	1995	42	42	108	0.5	94.2	-12.8
		4	1995	86	82	142	0.2	119.7	-15.7
		5	1995	54	52	137	0.2	134.6	-1.75
		6	1995	74	68	202	0.2	146	-27.7
		7	1995	83	77	203	0.2	126.1	-37.9
		8	1995	130	117	359	0.2	220.6	-38.6
		9	1995	73	73	135	0.2	92.7	-31.3
		10	1995	30	29	74	0.2		
		11	1995	0	0	0	0.2		
		12	1995	0	0	0	0.2		
		1	1996	77	76	252	0.2		
		2	1996	80	70	243	0.2		
		3	1996	24	23	137	0.22		
		4	1996	25	25	100	0.2		
		5	1996	96	96	362	0.21		
		Total (0.2NCF)		500	469	1178		839.7	-152.95
		Average		83.33	78.17	196.33		139.95	-25.49
		Variance		647.87	467.77	7354.27		1880.82	204.79
		Std Deviation		25.45	21.63	85.76		43.37	14.31
		Overall Total		542	511	1286		933.9	-165.75
		Average		77.43	73	183.71		133.41	-23.68
		Variance		783.95	576.67	7243.24		1866.36	193.67
		Std Deviation		28	24.01	85.11		43.2	13.92

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)		Bubble Dose (mrem)	
Person	Month	Year		(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP30	5	1993		15	0	40	0.4	28.58	-28.55
	6	1993		15	15	60	0.4	39.42	-34.3
	7	1993		0	0	12	0.4	11.28	-6
	8	1993		26	26	69	0.4	39.71	-42.45
	9	1993		18	18	44	0.4		
	10	1993		17	19	31	0.4	29.52	-4.774
	11	1993		17	14	50	0.4	30.63	-38.74
	12	1993		18	18	52	0.4	48.26	-7.192
	1	1994		19	19	52	0.4	53.2	2.308
	2	1994		23	24	83	0.4	35.5	-57.23
	3	1994		31	30	76	0.4		
	4	1994		10	0	27	0.4		
	5	1994		14	14	19	0.4		
	6	1994		12	11	34	0.4	8.34	-75.47
	7	1994		20	20	24	0.2	31.3	30.42
	8	1994		21	21	33	0.2	66	100
	9	1994		32	30	56	0.2	62.9	12.32
	10	1994		30	29	59	0.2	82	38.98
	11	1994		54	48	85	0.2	97.7	14.94
	12	1994		61	56	81	0.2	93	14.81
	1	1995		49	47	86	0.2	76.4	-11.16
	2	1995		67	62	122	0.2	135.1	10.74
	3	1995		57	53	86	0.2	93.9	9.186
	4	1995		35	33	57	0.2	44.9	-21.23
	5	1995		56	52	75	0.2	67.3	-10.27
	6	1995		45	45	67	0.2	93.5	39.55
	7	1995		42	40	70	0.2	55.2	-21.14
	8	1995		61	57	107	0.2	130.1	21.59
	9	1995		54	40	88	0.2	97.5	10.8
	10	1995		39	39	59	0.22	80.1	35.76
	11	1995		45	43	80	0.21		
	12	1995		51	36	75	0.21	88.81	18.41
	1	1996		78	55	128	0.22	110.5	-13.7
	2	1996		51	50	123	0.22	118.9	-3.317
	3	1996		77	72	167	0.2	204.2	22.26
	4	1996		24	22	90	0.19	142.5	58.38
	5	1996		75	72	155	0.19	222.3	43.39
	Total (0.19NCF)			99	94	245		364.8	101.77
	Average			49.5	47	122.5		182.4	50.89
	Variance			1300.5	1250	2112.5		3184.02	112.35
	Std Deviation			36.06	35.36	45.96		56.43	10.6
	Total (0.2NCF)			761	705	1263		1431	261.8
	Average			47.56	44.06	78.94		89.44	16.36
	Variance			270.8	218.06	1159.4		1706.4	848.36
	Std Deviation			16.46	14.77	34.05		41.31	29.13
	Total (0.22NCF)			168	144	310		309.5	18.74
	Average			56	48	103.33		103.17	6.25
	Variance			399	67	1480.33		416.69	680.19
	Std Deviation			19.97	8.19	38.48		20.41	26.08
	Total (0.4NCF)			162	146	483		324.44	-292.4
	Average			16.2	14.6	48.3		32.44	-29.24
	Variance			48.62	78.71	410.01		205.27	647.95
	Std Deviation			6.97	8.87	20.25		14.33	25.45
	Overall Total			1241	1125	2376		2518.55	108.32
	Average			38.78	35.16	74.25		78.7	3.39
	Variance			458.08	375.3	1304.32		2519.59	1230.03
	Std Deviation			21.4	19.37	36.12		50.2	35.07

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP31		5	1993	0	0	13	0.2	14.83	14.08
		6	1993	0	0	13	0.2	14.18	9.077
		7	1993	0	0	17	0.2	30.94	82
		8	1993	0	0	19	0.2	17.22	-9.368
		9	1993	13	12	33	0.2	19.41	-41.18
		10	1993	20	18	33	0.2	33.86	2.606
		11	1993	26	25	46	0.2	54.54	18.57
		12	1993	45	38	63	0.2	83.28	32.19
		1	1994	0	0	0	0.5		
		1	1994	11	0	28	0.2	29	3.571
		2	1994	0	0	20	0.2	16.2	-19
		3	1994	18	18	22	0.2		
		4	1994	0	0	29	0.7		
		5	1994	13	0	18	0.7		
		6	1994	0	0	13	0.7		
		7	1994	35	33	68	0.7		
		8	1994	0	0	23	0.7		
		9	1994	0	0	38	0.7		
		10	1994	15	14	66	0.7		
		11	1994	11	0	28	0.7		
		12	1994	0	0	34	0.7		
		1	1995	10	0	38	0.7		
		2	1995	0	0	41	0.7		
		3	1995	50	50	36	0.7		
		4	1995	0	0	24	0.7		
		5	1995	15	14	48	0.7		
		6	1995	16	16	53	0.7		
		7	1995	0	0	30	0.7		
		8	1995	40	26	64	0.7		
		9	1995	16	15	11	0.2		
		10	1995	13	12	14	0.32		
		11	1995	30	29	14	0.24		
		12	1995	0	0	6	0.28		
		1	1996	11	0	11	0.27		
		2	1996	18	13	14	0.29		
		3	1996	57	54	27	0.28		
		4	1996	106	103	23	0.24		
		5	1996	0	0	8	0.22		
		Total		115	93	285		313.46	92.55
		Average		0.5	9.3	28.5		31.35	9.25
		Variance		229.83	185.79	256.94		487.33	1077.03
		Std Deviation		15.16	13.63	16.03		22.08	32.82

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
Person		Month	Year	Dose (mrem)	Dose (mrem)	Dose (mrem)	NCF	Dose (mrem)	% Diff.
EMP32		5	1993	24	21	37	0.7		
		6	1993	21	15	14	0.7		
		7	1993	0	0	27	0.7		
		8	1993	22	19	30	0.7		
		9	1993	0	0	16	0.7		
		10	1993	12	0	12	0.7		
		11	1993	10	0	19	0.7		
		12	1993	15	0	14	0.7		
		1	1994	19	13	32	0.7		
		2	1994	0	0	16	0.7		
		3	1994	0	0	9	0.7		
		4	1994	0	0	7	0.7		
		5	1994	0	0	0	0.7		
		6	1994	0	0	0	0.7		
		7	1994	0	0	7	0.7		
		8	1994	0	0	0	0.7		
		9	1994	0	0	0	0.7		
		10	1994	15	13	12	0.7		
		11	1994	23	21	23	0.7		
		12	1994	0	0	14	0.7		
		1	1995	81	78	168	0.2	161.3	-3.99
		2	1995	79	79	126	0.2	163.8	30
		3	1995	59	59	102	0.2	68	-33.3
		4	1995	49	47	98	0.2	116.2	18.57
		5	1995	62	61	161	0.2	95.7	-40.6
		6	1995	66	66	81	0.2	60.9	-24.8
		7	1995	55	48	188	0.2	93.5	-50.3
		8	1995	99	93	121	0.2	191.5	58.26
		9	1995	38	23	77	0.2	30.4	-60.5
		10	1995	69	69	161	0.2		
		11	1995	0	0	9	0.2		
		12	1995	0	0	0	0.2		
		1	1996	0	0	9	0.2		
		2	1996	0	0	9	0.28		
		3	1996	0	0	0	0.38		
		4	1996	0	0	13	0.28		
		5	1996	11	11	23	0.2		
		Total		588	554	1122		981.3	-106.66
		Average		65.33	61.56	124.67		109.03	-11.85
		Variance		342.25	434.03	1578.5		2898.27	1619.2
		Std Deviation		18.5	20.83	39.73		53.84	40.24

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP33		5	1993	10	0	28	0.2	32.57	16.32
		6	1993	0	0	25	0.2		
		7	1993	0	0	15	0.2	22.78	51.87
		8	1993	27	23	36	0.2	45.98	27.72
		9	1993	12	10	26	0.2	11.35	-56.35
		10	1993	12	12	40	0.2	32.72	-18.2
		11	1993	0	0	26	0.2	18.58	-28.54
		12	1993	33	17	36	0.2	36.82	2.278
		1	1994	18	17	59	0.2	47	-20.34
		2	1994	66	66	164	0.2	104	-36.59
		3	1994	68	69	114	0.2	92.3	-19.04
		4	1994	0	0	14	0.2	12.42	-11.29
		5	1994	0	0	12	0.2	13.8	15
		6	1994	0	0	7	0.2	1.72	-75.43
		7	1994	18	18	55	0.2	58.7	6.727
		8	1994	10	0	44	0.2	67.9	54.32
		9	1994	13	12	51	0.2	44.6	-12.55
		10	1994	81	0	13	0.2	30.5	134.6
		11	1994	31	0	45	0.2	56.7	26
		12	1994	33	20	42	0.2	54	28.57
		1	1995	26	26	77	0.2	81.4	5.714
		2	1995	25	22	58	0.2	96.2	65.86
		3	1995	25	24	74	0.2	83.2	12.43
		4	1995	34	30	77	0.2	63.1	-18.05
		5	1995	27	27	77	0.2	88.5	14.94
		6	1995	25	24	79	0.2	74	-6.329
		7	1995	11	0	41	0.2	29.5	-28.05
		8	1995	0	0	9	0.2	5.6	-37.78
		9	1995	0	0	0	0.23		
		10	1995	0	0	2	0.23		
		11	1995	18	18	0	0.5		
		12	1995	0	0	0	0.2		
		1	1996	0	0	4	0.22		
		2	1996	0	0	4	0.21		
		3	1996	0	0	6	0.26		
		4	1996	0	0	16	0.16		
		5	1996	0	0	6	0.19		
		Total		605	417	1319		1305.94	93.81
		Average		22.41	15.44	48.85		48.37	3.47
		Variance		450.56	339.87	1055.34		900.8	1768.21
		Std Deviation		21.23	18.44	35.1		30.01	42.05

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP34		5	1993	0	0	0	0.4		
		6	1993	0	0	0	0.4	10.07	
		7	1993	0	0	0	0.4	3.85	
		8	1993	0	0	14	0.4	9.57	-31.6
		9	1993	0	0	19	0.4	16.72	-12
		10	1993	0	0	13	0.4	16.03	23.31
		11	1993	0	0	12	0.4	9.38	-21.8
		12	1993	0	0	0	0.4	12.19	
		1	1994	0	0	15	0.4	10.9	-27.3
		2	1994	0	0	20	0.4	6.9	-65.5
		3	1994	0	0	0	0.5		
		3	1994	0	0	43	0.4	22.6	-47.4
		4	1994	0	0	19	0.4	15.21	-19.9
		5	1994	0	0	0	0.4		
		6	1994	0	0	5	0.4		
		7	1994	15	14	61	0.4	32.3	-47
		8	1994	0	0	37	0.4	16.5	-55.4
		9	1994	0	0	26	0.4		
		10	1994	0	0	24	0.4		
		11	1994	15	14	56	0.4		
		12	1994	13	0	43	0.4		
		1	1995	21	11	50	0.4		
		2	1995	0	0	17	0.4		
		3	1995	26	24	104	0.4		
		4	1995	0	0	29	0.4		
		5	1995	0	0	4	0.4		
		6	1995	0	0	30	0.4		
		7	1995	0	0	9	0.4		
		8	1995	13	11	55	0.4		
		9	1995	13	13	56	0.4		
		10	1995	0	0	11	0.2		
		11	1995	0	0	12	0.2		
		12	1995	0	0	0	0.2		
		1	1996	0	0	17	0.2		
		2	1996	32	32	43	0.3		
		3	1996	16	15	41	0.2		
		4	1996	33	33	102	0.3		
		5	1996	41	41	96	0.2		
		Total		15	14	253		182.22	
		Average		1.15	1.08	19.46		14.02	
		Variance		17.31	15.08	322.6		54.23	
		Std Deviation		4.16	3.88	17.96		7.36	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP35		5	1993	0	0	20	0.2	26.51	32.55
		6	1993	15	0	13	0.2	17.68	36
		7	1993	0	0	0	0.2		
		8	1993	0	0	27	0.2	35.25	30.56
		9	1993	0	0	0	0.2	8.25	
		10	1993	0	0	0	0.2		
		11	1993	0	0	0	0.2	1.58	
		12	1993	0	0	0	0.2		
		1	1994	0	0	0	0.2		
		2	1994	0	0	19	0.2		
		3	1994	0	0	16	0.2		
		4	1994	0	0	6	0.2		
		5	1994	0	0	0	0.2		
		6	1994	0	0	0	0.2		
		7	1994	0	0	33	0.2		
		8	1994	0	0	23	0.2		
		9	1994	0	0	36	0.2		
		10	1994	13	12	50	0.2		
		11	1994	12	12	39	0.2		
		12	1994	13	0	28	0.2		
		1	1995	0	0	19	0.5		
		1	1995	23	23	62	0.2		
		2	1995	11	0	28	0.2		
		3	1995	0	0	0	0.2		
		4	1995	0	0	6	0.2		
		5	1995	11	11	42	0.2		
		6	1995	0	0	23	0.2		
		7	1995	0	0	0	0.2		
		8	1995	0	0	0	0.2		
		9	1995	0	0	0	0.2		
		10	1995	0	0	0	0.2		
		Total		15	0	60		89.27	
		Average		3	0	12		17.85	
		Variance		45	0	144.5		183.66	
		Std Deviation		6.71	0	12.02		13.55	

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP36	5	1993	20	15	24	0.4		
	6	1993	0	0	12	0.4		
	7	1993	0	0	0	0.4		
	8	1993	15	15	36	0.4		
	9	1993	0	0	20	0.4		
	10	1993	11	11	29	0.4		
	11	1993	0	0	15	0.4		
	12	1993	14	14	23	0.4		
	1	1994	0	0	13	0.4		
	2	1994	0	0	10	0.4		
	3	1994	0	0	18	0.4		
	4	1994	0	0	12	0.4		
	5	1994	16	15	16	0.4		
	6	1994	18	18	63	0.4		
	7	1994	18	17	35	0.2	39.5	12.857
	8	1994	33	31	79	0.2	96.2	21.772
	9	1994	90	55	105	0.2	97.5	-7.143
	10	1994	45	40	66	0.2	111.8	69.394
	11	1994	113	105	130	0.2	153.9	18.385
	12	1994	24	19	40	0.2	55.3	38.25
	1	1995	31	31	77	0.2	69.5	-9.74
	2	1995	58	58	79	0.2	117.5	48.734
	3	1995	44	42	86	0.2	113	31.395
	4	1995	50	49	75	0.2	105.3	40.4
	5	1995	33	33	86	0.2	129	50
	6	1995	57	55	110	0.2	111.1	1
	7	1995	42	38	92	0.2	122	32.609
	8	1995	64	63	145	0.2	149.6	3.1724
	9	1995	15	12	47	0.2	60.9	29.574
	10	1995	43	37	124	0.2	72.5	-41.53
	11	1995	18	17	84	0.23	59.3	-29.4
	12	1995	17	17	40	0.2	45.62	14.05
	1	1996	44	42	124	0.21	99.34	-19.89
	2	1996	37	36	122	0.22	68.5	-43.85
	3	1996	17	13	93	0.26	110.6	18.925
	4	1996	18	18	79	0.21	86.63	9.6582
	5	1996	59	59	224	0.21	113.4	-49.38
Total (0.2NCF)			777	702	1416		1677.1	297.6
Average			45.71	41.29	83.29		98.65	17.51
Variation			668.22	505.72	1047.92		1067.24	942.71
Std Deviation			25.85	22.49	32.37		32.67	30.7
Total (0.21NCF)			121	119	427		299.37	-59.61
Average			40.33	39.67	142.33		99.79	-19.87
Variation			430.33	424.33	5508.33		179.31	871.38
Std Deviation			20.74	20.6	74.22		13.39	29.52
Overall Total			970	887	2142		2187.99	239.24
Average			42.17	38.57	93.13		95.13	10.4
Variance			591.79	463.44	1709.3		994.64	1015.9
Std Deviation			24.33	21.53	41.34		31.54	31.87

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP37		5	1993	0	0	0	0.2	2.7	
		6	1993	0	0	0	0.2		
		7	1993	0	0	0	0.2	1.19	
		8	1993	0	0	11	0.2	9.1	-17.27
		9	1993	0	0	12	0.2	7.81	-34.92
		10	1993	0	0	0	0.2	14.22	
		11	1993	0	0	0	0.2	13.89	
		12	1993	0	0	11	0.2	24.77	125.2
		1	1994	0	0	12	0.2	6	-50
		2	1994	14	12	29	0.2	15.1	-47.93
		3	1994	30	27	62	0.2	48.8	-21.29
		4	1994	13	14	22	0.2	29.03	31.95
		5	1994	0	0	0	0.2		
		6	1994	0	0	0	0.2		
		7	1994	0	0	10	0.2	7.5	-25
		8	1994	31	0	14	0.4		
		9	1994	16	16	9	0.4		
		10	1994	0	0	13	0.4		
		11	1994	0	0	14	0.4		
		12	1994	0	0	0	0.4		
		1	1995	13	13	50	0.4		
		2	1995	0	0	0	0.4		
		3	1995	16	16	67	0.4		
		4	1995	0	0	16	0.4		
		5	1995	0	0	14	0.4		
		6	1995	0	0	15	0.4		
		7	1995	0	0	10	0.4		
		8	1995	0	0	11	0.4		
		9	1995	0	0	16	0.4		
		10	1995	0	0	8	0.4		
		11	1995	0	0	3	0.24		
		12	1995	0	0	0	0.22		
		1	1996	0	0	11	0.27		
		2	1996	0	0	7	0.35		
		3	1996	0	0	0	0.4		
		4	1996	0	0	13	0.4		
		5	1996	11	10	108	0.4		
		Total		57	53	169		180.11	
		Average		4.75	4.42	14.08		15.01	
		Variation		90.39	75.9	310.81		182.03	
		Std Deviation		9.51	8.71	17.63		13.49	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP38		5	1993	0	0	10	0.4	8.7	-13.00
		6	1993	13	0	15	0.4	11.88	-20.80
		7	1993	0	0	16	0.4	17.14	7.13
		8	1993	0	0	26	0.4	21.29	-18.12
		9	1993	0	0	11	0.4	10.21	-7.18
		10	1993	28	26	46	0.4	51.34	11.61
		11	1993	0	0	21	0.4	19.07	-9.19
		12	1993	13	13	24	0.4	23.8	-0.83
		1	1994	0	0	20	0.4	20.4	2.00
		2	1994	0	0	8	0.4	5	-37.50
		3	1994	0	0	21	0.4	10.5	-50.00
		4	1994	0	0	13	0.4	8.58	-34.00
		5	1994	0	0	0	0.4		
		6	1994	0	0	0	0.4		
		7	1994	29	28	81	0.4	54.3	-32.96
		8	1994	25	24	95	0.4	91.6	-3.58
		9	1994	13	13	40	0.4	27.1	-32.25
		10	1994	17	17	31	0.4	38.8	25.16
		11	1994	34	26	85	0.4	93.3	9.77
		12	1994	12	10	28	0.4	41.7	48.93
		1	1995	0	0	21	0.4		
		2	1995	0	0	9	0.4		
		3	1995	31	30	108	0.4		
		4	1995	29	29	75	0.4		
		5	1995	19	19	61	0.4		
		6	1995	0	0	21	0.4		
		7	1995	0	0	41	0.4		
		8	1995	35	35	151	0.4		
		9	1995	41	41	113	0.4		
		10	1995	0	0	0	0.28		
		Total		184	157	591		554.71	-154.82
		Average		10.22	8.72	32.83		30.82	-8.60
		Variance		145.01	121.74	725.68		716.89	602.86
		Std Deviation		12.04	11.03	26.94		26.77	24.55

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP39		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	0	0	0	0.5		
		3	1994	0	0	0	0.5		
		4	1994	0	0	0	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	0	0	0	0.5		
		8	1994	0	0	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	0	0	0	0.5		
		1	1995	0	0	0	0.4		
		2	1995	17	14	64	0.5		
		2	1995	0	0	0	0.4		
		3	1995	54	54	122	0.4	116.6	-4.426
		4	1995	43	36	86	0.4	111.4	29.53
		5	1995	53	50	150	0.4	135.8	-9.467
		6	1995	55	52	141	0.4	104.4	-25.96
		7	1995	29	28	57	0.4	44.1	-22.63
		8	1995	29	21	78	0.4		
		9	1995	13	12	45	0.4		
		10	1995	16	0	37	0.4		
		11	1995	20	18	70	0.4		
		12	1995	0	0	22	0.4		
		1	1996	0	0	25	0.25		
		2	1996	22	22	33	0.2		
		3	1996	0	0	46	0.4		
		4	1996	16	11	42	0.2		
		5	1996	26	25	69	0.17		
		Total		234	220	556		512.3	-32.95
		Average		46.8	44	111.2		102.46	-6.59
		Variance		122.2	130	1520.7		1200.27	487.52
		Std Deviation		11.05	11.4	39		34.64	22.08

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP40	5	1993	17	14	35	0.4		
	6	1993	0	0	17	0.4		
	7	1993	16	0	51	0.4		
	8	1993	19	16	67	0.4		
	9	1993	14	0	36	0.4		
	10	1993	0	0	23	0.4		
	11	1993	11	10	31	0.4		
	12	1993	32	21	32	0.4		
	1	1994	19	0	18	0.4		
	2	1994	12	12	31	0.4		
	3	1994	13	12	34	0.4		
	4	1994	0	0	12	0.4		
	5	1994	0	0	16	0.4		
	6	1994	0	0	18	0.4		
	7	1994	19	17	39	0.2	30.2	-22.56
	8	1994	48	40	62	0.2	74.3	19.84
	9	1994	62	30	58	0.2	57.9	-0.172
	10	1994	40	39	65	0.2	115.8	78.15
	11	1994	59	48	93	0.2	111.1	19.46
	12	1994	66	63	96	0.2	110.7	15.31
	1	1995	37	37	92	0.2	77	-16.3
	2	1995	55	55	95	0.2	107.7	13.37
	3	1995	53	51	72	0.2	101.5	40.97
	4	1995	38	38	52	0.2	60.2	15.77
	5	1995	52	52	74	0.2	64.8	-12.43
	6	1995	47	0	66	0.2	87.6	32.73
	7	1995	50	48	75	0.2	88.1	17.47
	8	1995	45	37	80	0.2	101.4	26.75
	9	1995	51	34	87	0.2	86.6	-0.46
	10	1995	29	29	50	0.2	32.2	-35.6
	11	1995	24	24	46	0.22		
	12	1995	19	18	77	0.2		
	1	1996	55	54	190	0.2		
	2	1996	25	25	94	0.2	114.7	22.02
	3	1996	28	24	68	0.2	133.9	96.96
	4	1996	0	0	7	0.2	5.54	-20.86
	5	1996	0	0	12	0.2	23.77	98.08
	Total		804	667	1337		1585.01	388.5
	Average		40.2	33.35	66.85		79.25	19.42
	Variance		345.33	334.34	652.45		1250.94	1363.3
	Std Deviation		18.58	18.29	25.54		35.37	36.92

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP41	5	1993	0	0	14	0.2	9.73	-30.5
	6	1993	0	0	12	0.2	17.45	45.42
	7	1993	12	11	30	0.2	24.69	-17.7
	8	1993	51	48	103	0.2	46.05	-55.29
	9	1993	18	18	38	0.2	27.5	-27.63
	10	1993	23	22	42	0.2	45.34	7.952
	11	1993	0	0	25	0.2	23.57	-5.72
	12	1993	15	13	56	0.4	36.97	-33.98
	1	1994	0	0	46	0.4	20.2	-56.09
	2	1994	10	0	48	0.4	33.7	-29.79
	3	1994	20	18	54	0.2	41.1	-23.89
	4	1994	0	0	20	0.4	35.37	76.85
	5	1994	0	0	22	0.4	14.82	-32.64
	6	1994	0	0	24	0.4	15.17	-36.79
	7	1994	12	11	64	0.4	20.4	-68.13
	8	1994	27	27	64	0.4	40.8	-36.25
	9	1994	11	10	60	0.4	34	-43.33
	10	1994	14	12	58	0.4	35.6	-38.62
	11	1994	18	18	94	0.4	53	-43.62
	12	1994	24	22	124	0.4	63.1	-49.11
	1	1995	20	19	148	0.4	78.8	-46.76
	2	1995	41	32	107	0.4	110.1	2.897
	3	1995	53	53	229	0.4	173.1	-24.41
	4	1995	0	0	69	0.4	76.2	10.43
	5	1995	0	0	0	0.4		
	6	1995	0	0	0	0.4		
	7	1995	0	0	0	0.4		
	8	1995	0	0	0	0.4		
	9	1995	0	0	0	0.4		
	10	1995	0	0	0	0.4		
	11	1995	0	0	3	0.24		
	12	1995	0	0	26	0.4		
	1	1996	0	0	3	0.23		
	2	1996	0	0	3	0.24		
	3	1996	0	0	0	0.2		
	4	1996	0	0	5	0.25		
	5	1996	0	0	3	0.18		
Total (0.2NCF)			114	99	312		235.43	-107.36
Average			14.25	12.38	39		29.43	-13.42
Variance			296.21	286.84	831.14		179.67	907.55
Std Deviation			17.21	16.94	28.83		13.4	30.13
Total (0.4NCF)			245	217	1233		841.33	-449.34
Average			15.31	13.56	77.06		52.58	-28.08
Variance			236.9	221.46	2928.06		1717.85	1162.2
Std Deviation			15.39	14.88	54.11		41.45	34.09
Overall Total			369	334	1551		1076.76	-556.7
Average			15.38	13.92	64.63		44.87	-23.2
Variance			244.77	224.95	2491.46		1299.34	1084
Std Deviation			15.65	15	49.91		36.05	32.92

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP42		5	1993	10	0	65	0.4	39.04	-39.94
		6	1993	13	0	51	0.4		
		7	1993	0	0	24	0.4		
		8	1993	15	14	76	0.4	36.21	-52.36
		9	1993	14	14	64	0.4	22	-65.63
		10	1993	0	0	36	0.4	25.23	-29.92
		11	1993	11	10	54	0.4	33.87	-37.28
		12	1993	13	12	70	0.4	45.67	-34.76
		1	1994	0	0	40	0.4		
		2	1994	14	12	85	0.4		
		3	1994	0	0	48	0.4		
		4	1994	0	0	14	0.4		
		5	1994	0	0	29	0.4		
		6	1994	15	0	54	0.4		
		7	1994	12	0	30	0.4		
		8	1994	14	0	61	0.4		
		9	1994	0	0	44	0.4		
		10	1994	14	14	105	0.4		
		11	1994	28	23	148	0.4		
		12	1994	18	18	96	0.4		
		1	1995	24	20	125	0.4		
		2	1995	0	0	53	0.4		
		3	1995	15	15	142	0.4		
		4	1995	0	0	20	0.4		
		5	1995	0	0	0	0.4		
		6	1995	41	33	88	0.5		
		7	1995	0	0	0	0.5		
		8	1995	0	0	0	0.5		
		9	1995	0	0	0	0.5		
		10	1995	0	0	0	0.5		
		11	1995	0	0	0	0.5		
		12	1995	0	0	0	0.5		
		1	1996	0	0	0	0.5		
		2	1996	0	0	0	0.5		
		3	1996	0	0	0	0.5		
		4	1996	0	0	0	0.5		
		5	1996	0	0	0	0.5		
		Total		63	50	365		202.02	-259.89
		Average		10.5	8.33	60.83		33.67	-43.32
		Variance		29.9	43.87	200.97		77.35	176.04
		Std Deviation		5.47	6.62	14.18		8.79	13.27

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP43		5	1993	12	10	61	0.4	47.87	-21.52
		6	1993	21	21	42	0.4	18.54	-55.86
		7	1993	0	0	24	0.4	49.08	104.5
		8	1993	0	0	21	0.4	24.39	16.14
		9	1993	0	0	11	0.4	2.43	-77.91
		10	1993	0	0	0	0.4	0.44	
		11	1993	15	14	29	0.4	59.03	103.6
		12	1993	0	0	0	0.4	6.67	
		1	1994	14	11	40	0.4		
		2	1994	0	0	23	0.4		
		3	1994	0	0	0	0.4		
		4	1994	0	0	0	0.4		
		5	1994	0	0	0	0.4		
		6	1994	0	0	0	0.4		
		7	1994	0	0	0	0.4		
		8	1994	0	0	0	0.4		
		9	1994	0	0	0	0.4		
		10	1994	0	0	0	0.4		
		11	1994	0	0	0	0.4		
		12	1994	0	0	0	0.4		
		1	1995	0	0	0	0.4		
		Total		48	45	188		208.45	
		Average		6	5.63	23.5		26.06	
		Variance		74.57	69.13	435.14		534.67	
		Std Deviation		8.64	8.31	20.86		23.12	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP44		5	1993	21	21	79	0.7		
		6	1993	12	0	16	0.7		
		7	1993	18	11	45	0.7		
		8	1993	0	0	32	0.7		
		9	1993	0	0	48	0.7		
		10	1993	10	11	34	0.7		
		11	1993	12	11	29	0.7		
		12	1993	13	12	48	0.7		
		1	1994	15	15	54	0.7		
		2	1994	0	0	21	0.7		
		3	1994	0	10	50	0.7		
		4	1994	0	0	21	0.7		
		5	1994	0	0	37	0.7		
		6	1994	38	38	135	0.7		
		7	1994	0	0	8	0.4		
		8	1994	15	15	36	0.4	47.1	30.83
		9	1994	26	26	75	0.4	71.1	-5.2
		10	1994	23	22	60	0.4	48.2	-19.67
		11	1994	40	39	112	0.4	125.2	11.79
		12	1994	80	59	91	0.4	87.4	-3.956
		1	1995	68	63	150	0.4	118.7	-20.87
		2	1995	52	50	131	0.4	114.8	-12.37
		3	1995	52	50	88	0.4	82.4	-6.364
		4	1995	60	36	52	0.4	39.5	-24.04
		5	1995	24	24	76	0.4	65.9	-13.29
		6	1995	33	31	84	0.4	55.5	-33.93
		7	1995	30	28	61	0.4	41	-32.79
		8	1995	19	18	64	0.4		
		9	1995	0	0	18	0.22		
		10	1995	18	0	18	0.24		
		11	1995	22	22	59	0.24		
		12	1995	0	0	9	0.26		
		12	1995	19	13	32	0.26		
		1	1996	11	10	32	0.25		
		2	1996	20	20	39	0.26		
		3	1996	40	37	59	0.3		
		4	1996	16	14	26	0.26		
		5	1996	45	43	49	0.24		
		Total		503	443	1016		896.8	-129.86
		Average		41.92	36.92	84.67		74.73	-10.82
		Variance		412.99	238.08	1089.7		964.78	338.53
		Std Deviation		20.32	15.43	33.01		31.06	18.4

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP45		5	1993	0	0	0	0.5	7.31	
		6	1993	17	0	0	0.2	4.17	
		7	1993	0	0	12	0.2	9.23	-23.08
		8	1993	18	16	42	0.2	31.6	-24.76
		9	1993	10	0	13	0.2	7.98	-38.62
		10	1993	34	32	17	0.2	49.48	191.1
		11	1993	0	0	0	0.2	1.87	
		12	1993	0	0	0	0.2	1.97	
		1	1994	0	0	0	0.2		
		2	1994	35	34	27	0.2		
		3	1994	0	0	17	0.2		
		4	1994	0	0	9	0.2		
		5	1994	18	18	0	0.2		
		6	1994	0	0	0	0.2		
		7	1994	0	0	20	0.2		
		8	1994	11	10	59	0.4		
		9	1994	16	16	50	0.4		
		10	1994	0	0	21	0.4		
		11	1994	19	16	63	0.4		
		12	1994	16	16	33	0.4		
		1	1995	22	19	76	0.4		
		2	1995	0	0	52	0.4		
		3	1995	29	25	106	0.4		
		4	1995	14	13	69	0.4		
		5	1995	18	17	106	0.4		
		6	1995	33	28	96	0.4		
		7	1995	25	25	153	0.4		
		8	1995	18	17	101	0.4		
		9	1995	29	29	113	0.4		
		10	1995	16	11	55	0.4		
		11	1995	14	14	47	0.25		
		12	1995	0	0	21	0.27		
		1	1996	31	31	128	0.28		
		2	1996	28	26	93	0.26		
		3	1996	21	20	57	0.25		
		4	1996	0	0	36	0.29		
		5	1996	16	14	54	0.19		
		Total (0.2NCF)		79	48	84		106.3	
		Average		11.29	6.86	12		15.19	
		Variance		162.9	158.48	226.33		334.37	
		Std Deviation		12.76	12.59	15.04		18.29	
		Overall Total		79	48	84		113.61	
		Average		9.88	6	10.5		14.2	
		Variance		155.55	141.71	212		294.36	
		Std Deviation		12.47	11.9	14.56		17.16	

Employee Monthly TLD and Bubble Dosimetry Results

Person	Month	Year	Shallow Dose (mrem)	Deep Dose (mrem)	Neutron Dose (mrem)	NCF	Bubble Dose (mrem)	% Diff.
EMP46	5	1993	0	0	0	0.5		
	5	1993	0	0	0	0.7		
	6	1993	0	0	0	0.7		
	7	1993	0	0	0	0.7		
	8	1993	0	0	0	0.7		
	9	1993	0	0	0	0.7		
	10	1993	0	0	0	0.7		
	11	1993	0	0	0	0.7		
	12	1993	0	0	0	0.7		
	1	1994	0	0	32	0.7		
	2	1994	0	0	0	0.7		
	3	1994	0	0	11	0.7		
	4	1994	0	0	0	0.7		
	5	1994	0	0	11	0.4	4.67	-57.5
	6	1994	0	0	33	0.7	9.55	-71.1
	7	1994	0	0	21	0.4		
	8	1994	17	17	41	0.4	50.1	22.2
	9	1994	0	0	48	0.4	40.9	-14.8
	10	1994	25	25	67	0.4	69	2.985
	11	1994	63	63	163	0.4	115.5	-29.1
	12	1994	0	0	24	0.4	63.6	165
	1	1995	53	43	114	0.4	105	-7.89
	2	1995	53	52	121	0.4	95	-21.5
	3	1995	71	71	136	0.4	147.4	8.382
	4	1995	59	39	90	0.4	88.9	-1.22
	5	1995	58	53	104	0.4	83.5	-19.7
	6	1995	42	42	103	0.4	101.1	-1.84
	7	1995	39	38	99	0.4	81.4	-17.8
	8	1995	44	41	98	0.4	88.5	-9.69
	9	1995	13	13	29	0.4	19.3	-33.4
	10	1995	18	18	20	0.21	38.1	90.5
	11	1995	27	26	38	0.21	8.6	-77.4
	12	1995	18	18	29	0.2	108.7	274.8
	1	1996	24	24	59	0.24	15.96	-72.9
	2	1996	47	47	63	0.23	167.2	165.3
	3	1996	18	18	25	0.21	8.56	-65.8
	4	1996	0	0	16	0.2	31.62	97.63
	5	1996	42	42	66	0.18	127.7	93.5
	Total (0.2NCF)		18	18	45		140.32	372.43
	Average		9	9	22.5		70.16	186.22
	Variance		162	162	84.5		2970.66	15694.6
	Std Deviation		12.73	12.73	9.19		54.5	125.28
	Total (0.21NCF)		63	62	83		55.26	-52.7
	Average		21	20.67	27.67		18.42	-17.57
	Variance		27	21.33	86.33		290.48	8792.44
	Std Deviation		5.2	4.62	9.29		17.04	93.77
	Total (0.4NCF)		537	497	1248		1153.87	-15.87
	Average		35.8	33.13	83.2		76.92	-1.06
	Variance		610.89	528.41	1986.46		1378.14	2471.15
	Std Deviation		24.72	22.99	44.57		37.12	49.71
	Overall Total		731	690	1597		1669.86	418.66
	Average		30.46	28.75	66.54		69.58	17.44
	Variance		511.39	444.54	1819.04		2212.77	7708.83
	Std Deviation		22.61	21.08	42.65		47.04	87.8

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person	Month	Year		(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP47	5	1993		0	0	0	0.7		
	6	1993		0	0	0	0.7		
	7	1993		0	0	0	0.7		
	8	1993		0	0	12	0.7		
	9	1993		0	0	0	0.7		
	10	1993		0	0	0	0.7		
	11	1993		0	0	13	0.7		
	12	1993		14	10	23	0.7		
	1	1994		0	0	23	0.7		
	2	1994		0	0	13	0.7		
	3	1994		0	0	13	0.7		
	4	1994		0	0	7	0.7		
	5	1994		0	0	0	0.7		
	6	1994		0	0	0	0.7		
	7	1994		18	13	70	0.4	39	-44.29
	8	1994		21	15	60	0.4	54.4	-9.333
	9	1994		0	0	22	0.4	23.3	5.909
	10	1994		30	24	71	0.4	41.9	-40.99
	11	1994		29	27	104	0.4	79.4	-23.65
	12	1994		17	15	87	0.4	65.6	-24.6
	1	1995		19	19	86	0.4	57.2	-33.49
	2	1995		15	12	44	0.4	29.1	-33.86
	3	1995		33	33	159	0.4	78.9	-50.38
	4	1995		16	14	85	0.4	79.6	-6.353
	5	1995		46	45	186	0.4	93.9	-49.52
	6	1995		29	15	87	0.4	26.3	-69.77
	7	1995		29	27	107	0.4	73.9	-30.93
	8	1995		39	37	181	0.4	89.5	-50.55
	9	1995		24	23	92	0.4	41.1	-55.33
	10	1995		31	29	57	0.2	60.9	6.842
	11	1995		0	0	26	0.2	7.4	-71.54
	12	1995		0	0	24	0.22	27.54	14.75
	1	1996		17	17	39	0.23	84.54	116.8
	2	1996		27	26	77	0.21	44.58	-42.1
	3	1996		26	26	74	0.21	85.27	15.23
	4	1996		14	14	44	0.19	36.2	-17.73
	5	1996		34	33	94	0.2	153.1	62.87
	Total (0.2NCF)			65	62	177		221.4	-1.83
	Average			21.67	20.67	59		73.8	-0.61
	Variance			354.33	324.33	1159		5431.93	4558.15
	Std Deviation			18.82	18.01	34.04		73.7	67.51
	Total (0.21NCF)			53	52	151		129.85	-26.87
	Average			26.5	26	75.5		64.93	-13.44
	Variance			0.5	0	4.5		827.84	1643.36
	Std Deviation			0.71	0	2.12		28.77	40.54
	Total (0.4NCF)			365	319	1441		873.1	-517.14
	Average			24.33	21.27	96.07		58.21	-34.48
	Variance			124.24	129.07	2189.64		565.42	417.12
	Std Deviation			11.15	11.36	46.79		23.78	20.42
	Overall Total			514	464	1876		1372.63	-432.02
	Average			22.35	20.17	81.57		59.68	-18.78
	Variance			142.78	136.24	2012.26		1022.53	1856.8
	Std Deviation			11.95	11.67	44.86		31.98	43.09

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP48		5	1993	0	0	0	0.2	9.64	
		6	1993	0	0	0	0.2		
		7	1993	0	0	0	0.2	2.08	
		8	1993	0	0	17	0.2	7.3	-57.06
		9	1993	21	21	25	0.2	8.16	-67.36
		10	1993	0	0	0	0.2	29.62	
		11	1993	16	14	21	0.2	20.82	-0.857
		12	1993	0	0	19	0.2	23.89	25.74
		1	1994	122	10	70	0.2	50.9	-27.29
		2	1994	55	54	119	0.2	97.7	-17.9
		3	1994	75	71	124	0.2	97.7	-21.21
		4	1994	0	0	13	0.2	12.94	-0.462
		5	1994	0	0	11	0.2	6.4	-41.82
		6	1994	0	0	14	0.2	4.07	-70.93
		7	1994	20	18	64	0.2	62.9	-1.719
		8	1994	28	25	56	0.2	64.5	15.18
		9	1994	41	39	117	0.2	91.1	-22.14
		10	1994	53	53	77	0.2	104	35.06
		11	1994	99	99	70	0.2	79	12.86
		12	1994	35	31	58	0.2	75.4	30
		1	1995	70	68	68	0.2		
		2	1995	70	68	125	0.2		
		3	1995	70	68	182	0.2		
		4	1995	106	103	49	0.2		
		5	1995	58	51	52	0.7		
		6	1995	20	20	16	0.7		
		7	1995	14	12	27	0.7		
		8	1995	19	0	41	0.7		
		9	1995	0	0	23	0.7		
		10	1995	0	0	14	0.2		
		11	1995	0	0	13	0.21		
		12	1995	0	0	7	0.21		
		1	1996	32	31	29	0.33		
		2	1996	119	96	78	0.37		
		3	1996	41	38	20	0.24		
		4	1996	18	17	14	0.2		
		5	1996	36	29	20	0.24		
Total				565	435	875		848.12	
Average				29.74	22.89	46.05		44.64	
Variance				1340.54	820.88	1747.61		1405.82	
Std Deviation				36.61	28.65	41.8		37.49	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP49		7	1994	0	0	0	0.5	0.3	
		8	1994	0	0	7	0.5		
		9	1994	0	0	5	0.5		
		9	1994	0	0	2	0.2		
		10	1994	10	0	35	0.2		
		11	1994	0	0	9	0.5		
		11	1994	12	10	42	0.2		
		12	1994	0	0	36	0.2		
		1	1995	11	11	29	0.2		
		2	1995	14	0	40	0.2		
		3	1995	12	12	56	0.2		
		4	1995	11	11	42	0.2		
		5	1995	0	0	31	0.2		
		6	1995	10	0	56	0.2		
		7	1995	0	0	40	0.2		
		8	1995	13	13	80	0.2		
		9	1995	0	0	11	0.5		
		9	1995	16	0	35	0.2		
		10	1995	15	14	66	0.2		
		11	1995	0	0	44	0.21		
		12	1995	10	10	39	0.2		
		1	1996	13	13	70	0.28		
		2	1996	15	0	59	0.22		
		3	1996	0	0	44	0.2		
		4	1996	0	0	50	0.23		
		5	1996	10	10	49	0.2		

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP50		5	1993	0	0	0	0.2		
		6	1993	0	0	0	0.2	9.7	
		7	1993	0	0	12	0.2	8.35	-30.42
		8	1993	37	37	68	0.2	52.68	-22.53
		9	1993	0	0	22	0.2	14.58	-33.73
		10	1993	25	23	45	0.2	60.16	33.69
		11	1993	15	13	30	0.2	52.66	75.53
		12	1993	60	58	77	0.2	101.6	31.95
		1	1994	28	26	84	0.2	98	16.67
		2	1994	68	67	136	0.2	113.2	-16.76
		3	1994	59	54	117	0.2	86.6	-25.98
		4	1994	0	0	3	0.2	13.44	348
		5	1994	0	0	5	0.2	7.76	55.2
		6	1994	0	0	6	0.2	4.59	-23.5
		7	1994	0	0	7	0.2	4.2	-40
		8	1994	15	13	39	0.2	45.4	16.41
		9	1994	44	44	70	0.2	94.3	34.71
		10	1994	17	15	41	0.2	52.1	27.07
		11	1994	43	37	63	0.2	67.1	6.508
		12	1994	96	92	122	0.2	98	-19.67
		1	1995	0	0	27	0.2	64.3	138.1
		2	1995	0	0	0	0.2		
		3	1995	0	0	0	0.2		
		4	1995	0	0	0	0.2		
		5	1995	0	0	0	0.2		
		6	1995	0	0	0	0.2		
		7	1995	0	0	8	0.2		
		8	1995	25	24	22	0.2		
		9	1995	0	0	0	0.2		
		10	1995	0	0	0	0.2		
		11	1995	0	0	0	0.2		
		12	1995	0	0	0	0.2		
		Total		507	479	974		1048.72	
		Average		25.35	23.95	48.7		52.44	
		Variance		808.98	747.52	1774.54		1420.11	
		Std Deviation		28.44	27.34	42.13		37.68	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP51		10	1993	0	0	0	0.5		
		2	1994	0	0	13	0.5		
		3	1994	0	0	0	0.2		
		3	1994	0	0	13	0.5		
		4	1994	0	0	8	0.2	7.35	-8.125
		5	1994	0	0	0	0.2		
		6	1994	0	0	4	0.2	5.32	33
		7	1994	13	11	38	0.2	43.3	13.95
		8	1994	25	22	39	0.2	50.7	30
		9	1994	42	42	69	0.2	54.9	-20.43
		10	1994	29	26	51	0.2	107.5	110.8
		11	1994	56	56	82	0.2	124.5	51.83
		12	1994	58	57	74	0.2	108.9	47.16
		1	1995	50	46	129	0.2	83.2	-35.5
		2	1995	67	61	116	0.2	126.4	8.966
		3	1995	48	47	68	0.2	91.4	34.41
		4	1995	27	25	37	0.2	63.9	72.7
		5	1995	28	28	40	0.2	53.3	33.25
		6	1995	36	35	54	0.2	63.4	17.41
		7	1995	49	49	72	0.2	97	34.72
		8	1995	34	34	64	0.2	105.9	65.47
		9	1995	44	44	105	0.2	99.3	-5.429
		10	1995	36	34	63	0.2	80.2	27.3
		11	1995	12	12	47	0.2	40.2	-14.47
		12	1995	0	0	0	0.2		
		1	1996	72	63	170	0.2	168.4	-0.941
		2	1996	48	40	111	0.2	178.3	60.63
		3	1996	34	26	104	0.21	184.5	77.4
		4	1996	42	42	134	0.2	179.2	33.73
		5	1996	50	48	170	0.19	246.7	45.12
		Total (0.2NCF)		816	774	1575		1932.57	590.43
		Average		37.09	35.18	71.59		87.84	26.84
		Variance		377.13	333.58	1719.87		2365.9	1167.49
		Std Deviation		19.42	18.26	41.47		48.64	34.17
		Overall Total		900	848	1849		2363.77	712.95
		Average		37.5	35.33	77.04		98.49	29.71
		Variance		351.83	315.36	2006.04		3545.27	1183.07
		Std Deviation		18.76	17.76	44.79		59.54	34.4

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP52		5	1993	28	25	53	0.4	43.8	-17.36
		6	1993	39	28	50	0.4	39.69	-20.62
		7	1993	18	17	43	0.4	27.57	-35.88
		8	1993	25	14	22	0.4	18.77	-14.68
		9	1993	0	0	15	0.4	8.1	-46
		10	1993	12	11	38	0.4	11.15	-70.66
		11	1993	24	23	58	0.4	79.48	37.03
		12	1993	17	18	46	0.4	47.16	2.522
		1	1994	26	17	42	0.4	48.5	15.48
		2	1994	36	36	81	0.4	79.2	-2.222
		3	1994	16	16	66	0.4	32.8	-50.3
		4	1994	0	0	20	0.4	21.46	7.3
		5	1994	0	0	14	0.4	5.81	-58.5
		6	1994	15	14	37	0.4	22.22	-39.95
		7	1994	11	11	30	0.4	24.2	-19.33
		8	1994	13	12	35	0.4	35.8	2.286
		9	1994	29	28	53	0.4	61.1	15.28
		10	1994	24	14	36	0.4	70.8	96.67
		11	1994	29	28	72	0.4	91.6	27.22
		12	1994	29	29	45	0.4	66.9	48.67
		1	1995	31	31	68	0.4	80.4	18.24
		2	1995	32	32	62	0.4	109.9	77.26
		3	1995	11	0	45	0.4	51.6	14.67
		4	1995	37	37	78	0.4	79	1.282
		5	1995	20	20	69	0.4	49.6	-28.12
		6	1995	44	23	120	0.4	94.4	-21.33
		7	1995	37	23	71	0.4	102.3	44.08
		8	1995	0	0	36	0.4	34.1	-5.278
		9	1995	13	11	84	0.4	48.5	-42.26
		10	1995	29	28	78	0.3	74.2	-4.872
		11	1995	0	0	41	0.2	35.7	-12.93
		12	1995	0	0	17	0.2	60.73	257.2
		1	1996	22	22	107	0.3	103.9	-2.897
		2	1996	43	43	128	0.3	248.5	94.14
		3	1996	43	32	119	0.3	136.1	14.37
		4	1996	38	18	99	0.3	119.5	20.71
		5	1996	44	42	116	0.3	225.3	94.22
Total (0.2NCF)				0	0	58		96.43	244.27
Average				0	0	29		48.22	122.14
Variance				0	0	288		313.25	36485.11
Std Deviation				0	0	16.97		17.7	191.01
Total (0.3NCF)				219	185	647		907.5	215.67
Average				36.5	30.83	107.83		151.25	35.95
Variance				81.9	104.97	313.37		4871.46	2130.99
Std Deviation				9.05	10.25	17.7		69.8	46.16
Total (0.4NCF)				616	518	1489		1485.91	-64.5
Average				21.24	17.86	17.86		51.24	-2.22
Variance				156.05	123.41	123.41		863.12	1535.96
Std Deviation				12.49	11.11	11.11		29.38	39.19
Overall Total				835	703	2194		2489.84	395.44
Average				22.57	19	59.3		67.29	10.69
Variance				194.81	155	978.16		2759.26	3434.73
Std Deviation				13.96	12.45	31.28		52.53	58.61

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP53		5	1993	0	0	0	0.4	7.48	
		6	1993	0	0	17	0.4	3.36	-80.24
		7	1993	0	0	0	0.4		
		8	1993	0	0	0	0.4	16.81	
		9	1993	0	0	0	0.5		
		9	1993	0	0	0	0.4		
		10	1993	0	0	0	0.4	1.49	
		11	1993	0	0	13	0.4	8.36	-35.69
		12	1993	0	0	0	0.5		
		12	1993	18	18	28	0.4	16.18	-42.21
		1	1994	0	0	12	0.4		
		2	1994	13	14	29	0.4		
		3	1994	0	0	9	0.4		
		4	1994	0	0	0	0.4		
		5	1994	0	0	4	0.4		
		6	1994	0	0	6	0.4		
		7	1994	0	0	7	0.4		
		8	1994	0	0	0	0.4		
		9	1994	0	0	8	0.4		
		10	1994	0	0	7	0.4		
		11	1994	24	24	50	0.4		
		12	1994	0	0	17	0.4		
		1	1995	0	0	7	0.4		
		2	1995	13	0	20	0.4		
		3	1995	40	33	107	0.4		
		4	1995	0	0	0	0.2		
		4	1995	0	0	12	0.4		
		5	1995	0	0	0	0.4		
		6	1995	0	0	0	0.4		
		7	1995	0	0	0	0.4		
		8	1995	0	0	28	0.4		
		9	1995	0	0	26	0.4		
		10	1995	0	0	10	0.2		
		11	1995	0	0	12	0.23		
		12	1995	0	0	0	0.66		
		1	1996	0	0	0	0.4		
		2	1996	0	0	0	0.4		
		3	1996	0	0	0	0.4		
		4	1996	0	0	0	0.16		
		5	1996	0	0	0	0.4		
		Total		18	18	58		53.68	
		Average		3	3	9.67		8.95	
		Variance		54	54	136.27		40.69	
		Std Deviation		7.35	7.35	11.67		6.38	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP54		5	1993	0	0	0	0.5		
		6	1993	0	0	0	0.5		
		7	1993	0	0	0	0.5		
		8	1993	0	0	0	0.5		
		9	1993	0	0	0	0.5		
		10	1993	0	0	0	0.5		
		11	1993	0	0	0	0.5		
		12	1993	0	0	0	0.5		
		1	1994	0	0	0	0.5		
		2	1994	0	0	0	0.5		
		3	1994	0	0	0	0.5		
		4	1994	0	0	0	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	0	0.5		
		7	1994	0	0	0	0.5		
		8	1994	17	16	0	0.5		
		9	1994	0	0	0	0.5		
		10	1994	0	0	0	0.5		
		11	1994	0	0	0	0.5		
		12	1994	0	0	0	0.5		
		1	1995	0	0	0	0.5		
		2	1995	0	0	0	0.5		
		3	1995	0	0	0	0.5		
		4	1995	0	0	3	0.2		
		5	1995	15	0	40	0.2		
		6	1995	160	139	371	0.2	108.4	-70.78
		7	1995	0	0	0	0.2	155.7	
		8	1995	62	57	121	0.2	162.1	33.97
		9	1995	26	24	57	0.2	69.1	21.23
		10	1995	61	58	126	0.2	98.8	-21.59
		11	1995	38	38	95	0.2	83.6	-12
		12	1995	0	0	0	0.2		
		1	1996	66	62	187	0.2	214.1	14.49
		2	1996	59	53	160	0.2	220.8	38
		3	1996	39	31	108	0.2	163.3	51.2
		4	1996	27	27	85	0.2	120.3	41.53
		5	1996	18	13	44	0.2	51.4	16.82
		Total		556	502	1354		1447.6	
		Average		55.6	50.2	135.4		131.6	
		Variance		1642.49	1251.73	8721.6		3166.29	
		Std Deviation		40.53	35.38	93.39		56.27	

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP55		5	1993	0	0	35	0.5		
		6	1993	16	13	46	0.5		
		7	1993	0	0	35	0.5		
		8	1993	0	0	31	0.5		
		9	1993	0	0	18	0.5		
		10	1993	0	0	22	0.5		
		11	1993	0	0	15	0.5		
		12	1993	0	0	30	0.5		
		1	1994	0	0	35	0.5		
		2	1994	0	0	34	0.5		
		3	1994	0	0	34	0.5		
		4	1994	0	0	21	0.5		
		5	1994	0	0	0	0.5		
		6	1994	0	0	12	0.5		
		7	1994	0	0	15	0.5		
		8	1994	22	21	143	0.5		
		9	1994	0	0	48	0.5		
		10	1994	12	12	96	0.5		
		11	1994	15	15	88	0.5		
		12	1994	0	0	42	0.5		
		1	1995	11	11	85	0.5		
		2	1995	0	0	59	0.5		
		3	1995	0	0	53	0.5		
		4	1995	27	26	66	0.2	63.1	-4.394
		5	1995	68	66	191	0.2	170.7	-10.63
		6	1995	73	70	185	0.2	173.3	-6.324
		7	1995	71	67	172	0.2	139.6	-18.84
		8	1995	82	82	169	0.2	207.8	22.96
		9	1995	34	30	103	0.2	105.9	2.816
		10	1995	49	46	141	0.2	133.7	-5.177
		11	1995	32	32	123	0.2	70.7	-42.52
		12	1995	36	36	89	0.2	162.3	82.36
		1	1996	14	14	35	0.2	138.2	294.9
		2	1996	73	70	175	0.2	236.7	35.26
		3	1996	23	21	113	0.2	196.7	74.07
		4	1996	28	26	135	0.2	176	30.37
		5	1996	70	69	229	0.2	333	45.41
		Total		680	655	1926		2307.7	500.26
		Average		48.57	46.79	137.57		164.84	35.73
		Variance		541.03	523.87	2851.49		4734.07	6806.5
		Std Deviation		23.26	22.89	53.4		68.8	82.5

Employee Monthly TLD and Bubble Dosimetry Results

				Shallow	Deep	Neutron		Bubble	
				Dose	Dose	Dose		Dose	
Person		Month	Year	(mrem)	(mrem)	(mrem)	NCF	(mrem)	% Diff.
EMP56		5	1993	21	17	68	0.4	30.44	-55.24
		6	1993	23	20	67	0.4	31.21	-53.42
		7	1993	30	32	91	0.4	45.93	-49.53
		8	1993	31	29	73	0.4	44.36	-39.23
		9	1993	25	24	73	0.4	19.96	-72.66
		10	1993	18	14	29	0.4	30.84	6.345
		11	1993	46	45	118	0.4	86.53	-26.67
		12	1993	21	21	45	0.4	51.85	15.22
		1	1994	17	16	52	0.4	40.6	-21.92
		2	1994	18	18	56	0.4	29.3	-47.68
		3	1994	26	20	45	0.4	23.7	-47.33
		4	1994	0	0	22	0.4	15.1	-31.36
		5	1994	10	10	25	0.4	7.19	-71.24
		6	1994	10	0	13	0.2	4.26	-67.23
		7	1994	22	15	53	0.2	36.1	-31.89
		8	1994	26	23	60	0.2	74.3	23.83
		9	1994	111	45	99	0.2	101.2	2.222
		10	1994	68	68	80	0.2	91.8	14.75
		11	1994	68	59	121	0.2	96.2	-20.5
		12	1994	44	41	72	0.2	68.6	-4.722
		1	1995	0	0	9	0.2		
		2	1995	19	19	0	0.5		
		3	1995	0	0	0	0.5		
		4	1995	0	0	0	0.5		
		5	1995	0	0	0	0.5		
		6	1995	0	0	0	0.5		
		7	1995	0	0	0	0.5		
		8	1995	0	0	0	0.5		
		9	1995	0	0	0	0.5		
		10	1995	0	0	0	0.5		
		11	1995	0	0	0	0.5		
		12	1995	0	0	0	0.5		
		1	1996	0	0	0	0.5		
		2	1996	0	0	0	0.5		
		3	1996	0	0	0	0.5		
		4	1996	0	0	0	0.5		
		5	1996	0	0	0	0.5		
		Total		635	517	1262		929.47	-578.26
		Average		31.75	25.85	63.1		46.47	-28.91
		Variance		648.93	319.61	883.57		901.41	908.6
		Std Deviation		25.47	17.88	29.72		30.02	30.14

APPENDIX D: LONGEVITY RESULTS FOR BUBBLE DOSIMETRY STUDY

Longevity Results for Bubble Dosimeters (Group 1)

Bubble Dosimeters

Type: BD-100R, non-temperature compensated

Group#1, used routinely at TA-55 after initial calibration of 9/93

Exposure: 20mRem

File I.D. Group1

No.	I.D.	Reader	Ini. Cal.				Cal.			Mar/94			Jun/94			Jul/94		
			Fact	Sensi.	Sigma	COV(%)	Sensi.	Sensi.	Sensi.	Mar/94	Jun/94	Jul/94	Mar/94	Jun/94	Jul/94	Mar/94	Jun/94	Jul/94
			Cal.	Sept/93			Mar/94	Jun/94	Jul/94	Norm.	Norm.	Norm.	Norm.	Norm.	Norm.	Norm.	Norm.	Norm.
1	13487 TA-55		1.2	2.77	0.14	5.05	3.17	0.00	0.00	1.14	0.00	0.00	SM-1898	3.01	0.39	12.98	3.45	0.00
2	14238 TA-55		1.2	3.72	0.13	3.49	4.20	0.00	0.00	1.13	0.00	0.00	SM-1898	4.12	0.14	3.40	4.65	0.00
3	13171 TA-55		1.2	2.50	0.07	2.80	3.12	0.00	0.00	1.25	0.00	0.00	SM-1898	2.85	0.57	20.00	3.37	0.00
4	15751 TA-55		1.2	2.62	0.18	6.87	3.85	0.00	0.00	1.47	0.00	0.00	SM-1898	2.97	0.54	18.18	4.28	0.00
5	14645 TA-55		1.3	3.21	0.27	8.41	2.85	0.00	0.00	0.89	0.00	0.00	SM-1898	3.57	0.70	19.61	3.27	0.00
6	15128 TA-55		1.9	4.38	0.36	8.26	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
7	14045 TA-55		2.0	4.89	0.22	4.50	6.02	5.05	0.00	1.23	1.03	0.00	SM-1898	5.33	0.44	8.26	6.92	6.26
8	14049 TA-55		2.1	3.90	0.32	8.21	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
9	13329 TA-55		2.1	4.32	0.39	9.03	6.43	5.41	0.00	1.49	1.25	0.00	SM-1898	5.16	0.80	15.50	6.68	6.33
10	14854 TA-55		2.2	4.93	0.19	3.85	5.58	0.00	0.00	1.13	0.00	0.00	SM-1898	5.48	1.03	18.86	6.12	0.00
11	13464 TA-55		2.3	5.67	0.32	5.64	6.10	0.00	0.00	1.08	0.00	0.00	SM-1898	6.25	0.30	4.80	6.52	0.00
12	14015 TA-55		2.4	5.08	0.18	3.54	5.10	5.40	0.00	1.00	1.06	0.00	SM-1898	5.46	0.84	15.38	5.55	5.83
13	14261 TA-55		3.1	5.83	0.40	6.86	6.55	6.09	0.00	1.12	1.04	0.00	SM-1898	6.92	0.72	10.40	7.17	7.50
14	14931 TA-55		3.1	6.60	0.26	3.94	7.60	0.00	0.00	1.15	0.00	0.00	SM-1898	8.04	0.48	5.97	8.57	0.00
15	14972 TA-55		3.3	6.21	0.53	8.53	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
16	14902 TA-55		3.4	5.70	0.08	1.05	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
17	14948 TA-55		3.5	7.00	0.21	3.00	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
18	15129 TA-55		3.6	7.66	0.11	1.44	8.07	0.00	0.00	1.05	0.00	0.00	SM-1898	8.49	0.68	8.01	9.05	0.00
19	14905 TA-55		3.6	7.09	0.37	5.22	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
20	15007 TA-55		3.7	7.32	0.44	6.01	8.10	0.00	0.00	1.11	0.00	0.00	SM-1898	8.07	0.71	8.80	8.97	0.00
21	14917 TA-55		3.8	7.07	0.37	5.23	8.35	0.00	0.00	1.18	0.00	0.00	SM-1898	7.78	0.17	2.19	8.57	0.00
22	14286 TA-55		3.8	7.09	0.11	1.55	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
23	13508 TA-55		3.9	7.00	0.28	4.00	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
24	14912 TA-55		4.0	7.17	0.52	7.25	7.03	0.00	0.00	0.98	0.00	0.00	SM-1898	8.14	0.59	7.25	8.05	0.00
25	15081 TA-55		4.1	8.28	0.77	9.32	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
26	13916 TA-55		4.8	8.60	0.71	8.26	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
27	13887 TA-55		5.3	8.80	0.18	2.05	9.75	0.00	0.00	1.11	0.00	0.00	SM-1898	9.04	0.28	3.10	11.35	0.00
28	13890 TA-55		5.3	9.55	0.68	7.12	11.68	0.00	0.00	1.22	0.00	0.00	SM-1898	11.10	1.49	13.42	12.93	0.00
29	14432 TA-55		16.0	14.56	0.20	1.37	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
30	14491 TA-55		16.0	15.06	0.97	8.44	15.17	0.00	0.00	1.01	0.00	0.00	SM-1898	17.81	0.94	5.28	18.88	0.00
31	14781 TA-55		17.0	15.93	0.90	5.65	14.45	0.00	0.00	0.91	0.00	0.00	SM-1898	19.07	1.21	6.35	20.02	0.00
32	14816 TA-55		17.0	16.05	0.28	1.74	16.13	0.00	0.00	1.00	0.00	0.00	SM-1898	21.69	0.95	4.38	22.92	0.00
33	14786 TA-55		17.0	15.72	0.56	3.56	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	21.76	1.56	7.17	22.92	0.00
34	14796 TA-55		18.0	16.23	0.30	1.85	15.98	0.00	0.00	0.98	0.00	0.00	SM-1898	20.60	0.92	4.47	22.03	0.00
35	14442 TA-55		18.0	15.53	0.28	1.80	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
36	14799 TA-55		18.0	17.28	0.21	1.22	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
37	16026 TA-55		19.0	16.56	0.23	1.39	15.95	0.00	0.00	0.98	0.00	0.00	SM-1898	21.72	0.88	4.05	22.57	0.00
38	14457 TA-55		19.0	15.77	1.05	6.66	17.37	0.00	0.00	1.10	0.00	0.00	SM-1898	20.58	0.71	3.45	22.08	0.00
39	14771 TA-55		19.0	16.20	0.44	2.72	15.85	0.00	0.00	0.98	0.00	0.00	SM-1898	20.93	1.15	5.49	22.78	0.00
40	14459 TA-55		20.0	15.05	1.50	9.97	14.48	0.00	0.00	0.96	0.00	0.00	SM-1898	19.73	1.21	6.13	20.02	0.00
41	14784 TA-55		20.0	16.50	0.37	2.24	15.73	0.00	0.00	0.95	0.00	0.00	SM-1898	22.53	1.84	8.17	20.05	0.00
42	15990 TA-55		20.0	14.86	0.73	4.91	14.02	0.00	0.00	0.94	0.00	0.00	SM-1898	23.22	1.53	6.59	22.77	0.00
43	14798 TA-55		20.0	16.40	0.03	0.18	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
44	14520 TA-55		21.0	15.44	0.41	2.66	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	20.55	1.14	5.55	0.00	0.00
45	14815 TA-55		21.0	16.00	1.29	8.06	15.07	0.00	0.00	0.94	0.00	0.00	SM-1898	22.64	1.45	6.40	23.60	0.00
46	14825 TA-55		21.0	16.03	1.50	9.36	15.30	0.00	0.00	0.95	0.00	0.00	SM-1898	22.43	2.14	9.54	23.17	0.00
47	16043 TA-55		22.0	17.18	1.23	7.16	15.55	0.00	0.00	0.91	0.00	0.00	SM-1898	23.68	1.91	8.07	23.37	0.00
48	14500 TA-55		22.0	16.66	0.60	3.60	15.37	0.00	0.00	0.92	0.00	0.00	SM-1898	21.47	1.64	7.64	21.93	0.00
49	14762 TA-55		22.0	16.50	0.36	2.18	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00
50	16024 TA-55		22.0	17.29	0.06	0.35	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00

Longevity Results for Bubble Dosimeters (Group 2)

Bubble Dosimeters

Type: BD-100R, non-temperature compensated

Group#2, used occasionally at TA-18 after initial calibration of 9/93

Exposure: 20 mRem

File I.D. Group2

No.	I.D.	Reader	Fact Cal.	Ini. Cal. Sensi. Sept/93	Sigma	COV(%)	Cal. Sensi. Mar/94	Cal. Sensi. Jun/94	Cal. Sensi. Jul/94	Mar/94 Norm.	Jun/94 Norm.	Jul/94 Norm.	Reader	Ini. Cal. Sensi. Feb/94	Sigma	COV(%)	Cal. Sensi. Mar/94	Cal. Sensi. Jun/94	Cal. Sensi. Jul/94	Mar/94 Norm.	Jun/94 Norm.	Jul/94 Norm.
51	14808	TA-55	1.2	3.23	0.28	8.67	3.42	3.37	3.39	1.06	1.04	1.05	SM-1898	3.16	0.08	2.53	3.45	3.72	3.78	1.09	1.18	1.20
52	14819	TA-55	1.2	2.80	0.14	5.00	2.47	2.70	0.00	0.88	0.96	0.00	SM-1898	2.78	0.21	7.55	2.47	3.34	0.00	0.89	0.00	0.00
53	13487	TA-55	1.3	2.92	0.23	7.88	3.53	0.00	0.00	1.21	0.00	0.00	SM-1898	2.60	0.54	20.77	3.60	0.00	0.00	1.38	0.00	0.00
54	14284	TA-55	1.5	3.68	0.37	10.11	4.25	4.10	0.00	1.16	1.12	0.00	SM-1898	3.88	0.71	18.30	4.63	4.81	0.00	1.19	0.00	0.00
55	14247	TA-55	1.6	3.70	0.29	7.84	3.90	3.93	0.00	1.05	1.06	0.00	SM-1898	4.21	0.27	8.41	3.95	4.71	0.00	0.94	0.00	0.00
56	14292	TA-55	1.6	2.96	0.28	9.46	4.05	3.91	0.00	1.37	1.32	0.00	SM-1898	3.76	0.35	9.31	4.55	4.41	0.00	1.21	0.00	0.00
57	14082	TA-55	1.7	3.02	0.29	9.60	0.00	0.00	0.00	0.00	0.00	0.00	SM-1898	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	14074	TA-55	1.8	3.70	0.19	5.14	3.33	0.00	0.00	0.90	0.00	0.00	SM-1898	3.99	0.88	22.06	3.57	0.00	0.00	0.89	0.00	0.00
59	14989	TA-55	1.8	4.40	0.28	6.36	4.78	5.15	0.00	1.09	1.17	0.00	SM-1898	4.97	0.08	1.21	5.50	6.12	0.00	1.11	0.00	0.00
60	14210	TA-55	1.9	4.30	0.26	6.05	4.83	4.50	0.00	1.12	1.05	0.00	SM-1898	4.80	0.40	8.33	5.83	5.34	0.00	1.21	0.00	0.00
61	14969	TA-55	1.9	4.50	0.10	2.22	4.82	4.74	0.00	1.07	1.05	0.00	SM-1898	4.18	1.15	27.84	4.95	5.28	0.00	1.19	0.00	0.00
62	14001	TA-55	1.9	5.42	0.43	7.93	6.05	5.97	0.00	1.12	1.10	0.00	SM-1898	5.59	0.48	8.59	6.40	6.77	0.00	1.14	0.00	0.00
63	14037	TA-55	2.0	5.50	0.46	8.36	4.83	4.88	5.37	0.84	0.89	0.98	SM-1898	5.17	0.71	13.73	4.95	5.89	5.83	0.96	1.10	1.13
64	14023	TA-55	2.0	4.92	0.11	2.24	5.23	5.58	0.00	1.06	1.13	0.00	SM-1898	6.12	0.54	8.82	5.70	6.72	0.00	0.93	0.00	0.00
65	14054	TA-55	2.1	4.90	0.15	3.06	6.00	0.00	0.00	1.22	0.00	0.00	SM-1898	5.45	0.59	10.83	7.22	0.00	0.00	1.32	0.00	0.00
66	14017	TA-55	2.1	4.98	0.46	9.24	6.08	5.00	0.00	1.22	1.16	0.00	SM-1898	5.29	0.36	6.81	6.53	6.62	0.00	1.23	0.00	0.00
67	14175	TA-55	2.3	4.90	0.58	11.84	5.70	4.65	0.00	1.16	0.95	0.00	SM-1898	6.03	0.23	3.81	6.00	5.57	0.00	1.00	0.00	0.00
68	14174	TA-55	2.4	5.79	0.41	7.08	7.10	6.39	0.00	1.23	1.10	0.00	SM-1898	7.35	0.29	3.95	8.10	7.50	0.00	1.10	0.00	0.00
69	14437	TA-55	16.0	14.84	1.22	8.33	14.88	13.53	0.00	1.00	0.92	0.00	SM-1898	19.43	1.79	9.21	19.87	19.95	0.00	1.02	0.00	0.00
70	14821	TA-55	17.0	15.90	1.12	7.04	16.52	15.32	0.00	1.04	0.96	0.00	SM-1898	20.00	0.74	3.70	22.63	21.19	0.00	1.13	0.00	0.00
71	14784	TA-55	17.0	15.21	0.12	0.79	16.35	14.20	0.00	1.07	0.93	0.00	SM-1898	20.55	1.72	8.37	22.02	21.24	0.00	1.07	0.00	0.00
72	14425	TA-55	18.0	16.58	0.40	2.41	16.98	15.35	0.00	1.02	0.93	0.00	SM-1898	21.80	1.63	7.48	22.22	22.44	0.00	1.02	0.00	0.00
73	14791	TA-55	19.0	16.40	0.77	4.70	16.15	14.82	0.00	0.98	0.90	0.00	SM-1898	22.67	2.20	9.70	23.37	22.07	0.00	1.03	0.00	0.00
74	14418	TA-55	19.0	15.80	0.46	2.91	15.55	14.08	0.00	0.98	0.89	0.00	SM-1898	21.93	0.14	0.64	22.40	20.80	0.00	1.02	0.00	0.00
75	14814	TA-55	19.0	15.67	0.94	6.00	15.30	14.48	0.00	0.98	0.92	0.00	SM-1898	21.85	2.25	10.30	22.42	22.34	0.00	1.03	0.00	0.00
76	14782	TA-55	19.0	16.40	0.13	0.79	16.38	14.58	0.00	1.00	0.89	0.00	SM-1898	22.61	1.87	8.27	23.37	21.95	0.00	1.03	0.00	0.00
77	14443	TA-55	19.0	16.31	0.19	1.16	14.70	14.45	0.00	0.90	0.92	0.00	SM-1898	20.90	1.31	6.27	22.32	22.52	0.00	1.07	0.00	0.00
78	14795	TA-55	19.0	17.23	0.80	4.64	16.02	15.47	0.00	0.93	0.90	0.00	SM-1898	21.86	1.64	7.50	22.25	21.69	0.00	1.02	0.00	0.00
79	16203	TA-55	20.0	17.59	0.58	3.30	15.80	15.53	0.00	0.89	0.88	0.00	SM-1898	22.18	1.14	5.14	22.78	22.62	0.00	1.03	0.00	0.00
80	14732	TA-55	20.0	15.34	0.18	1.17	15.28	15.20	0.00	1.00	0.99	0.00	SM-1898	21.42	1.32	6.16	21.12	21.45	0.00	0.99	0.00	0.00
81	14777	TA-55	20.0	16.65	0.42	2.52	15.82	14.55	0.00	0.95	0.87	0.00	SM-1898	22.68	1.03	4.54	23.55	21.51	0.00	1.04	0.00	0.00
82	14785	TA-55	20.0	17.19	0.11	0.84	17.22	0.00	0.00	1.00	0.00	0.00	SM-1898	23.11	1.94	8.39	24.00	0.00	0.00	1.04	0.00	0.00
83	14828	TA-55	21.0	18.05	0.71	3.93	15.68	0.00	0.00	0.87	0.00	0.00	SM-1898	24.76	1.50	6.06	23.58	0.00	0.00	0.95	0.00	0.00
84	16011	TA-55	21.0	17.16	0.23	1.34	15.02	14.38	0.00	0.88	0.84	0.00	SM-1898	22.45	1.16	5.17	22.40	21.60	0.00	1.00	0.00	0.00
85	16214	TA-55	21.0	16.44	0.67	4.08	16.17	14.87	0.00	0.98	0.90	0.00	SM-1898	22.91	0.96	4.19	22.35	22.64	0.00	0.98	0.00	0.00
86	14727	TA-55	21.0	16.30	1.22	7.48	15.32	14.07	0.00	0.94	0.88	0.00	SM-1898	23.34	2.62	11.23	23.80	22.58	0.00	1.02	0.00	0.00
87	14775	TA-55	22.0	16.29	0.65	3.99	15.63	14.83	0.00	0.96	0.91	0.00	SM-1898	23.28	1.19	5.11	22.75	22.70	0.00	0.98	0.00	0.00
88	16010	TA-55	22.0	16.41	0.23	1.40	15.90	14.48	0.00	0.97	0.88	0.00	SM-1898	22.49	1.52	6.76	22.87	22.02	0.00	1.02	0.00	0.00

Bubble Dosimeters

Type: BD-100R, non-temperature compensated
Group#3, never used in the field, except for calibration purposes after initial calibration of 9/93

Exposure: 20mRem

File I.D. Group3

[illegible]