APPENDIX XIX: RADIATION SAFETY; X-RAY GENERATION AND DETECTION

EQUIPMENT OPERATION

The Tel-Atomic Tel-X-Ometer instrument utilizes a Cu-K_α x-ray tube which can operate at either 20 kV or 30 kV electron energies. The electron bombardment of the Cu target yields Bremsstrahlung radiation and characteristic x-radiation from the copper. The electron beam current may be adjusted from a few microamps to ~80 μA. This current must be monitored with an external microammeter plugged into the terminals at the front right side of the instrument. **Do not operate the x-ray unit at currents above 80 μA except for short periods of time, and then only as necessary for low count rate experiments.**

RADIATION SAFETY

Find out how the unit of exposure (dose rate) for electromagnetic radiation--the Roentgen (R)--is defined, and what is considered a "safe" dose rate for occupational exposure (40 hr/wk x 50 wks/yr). Note that even this non-professional x-ray unit can provide doses of over 100 R/hr near the target, so appropriate precautions must be taken. To provide safety for the user, the unit is covered by an interlocked, lead-impregnated shield and a lead "beam stop" located in the primary beam.

1. Place the 1 mm collimator (582-001) in the x-ray tube output hole--seat it carefully and orient it vertically. Set the voltage to 30 kV. Close the chamber lid and slide it into the center (interlocked) position. DO NOT FORCE THE CHAMBER LID! Turn on the unit by
    a) rotating the timer switch to its maximum CW position,
    b) turning on the key switch, and
    c) pressing the red "x-rays on" button.

If the "x-rays on" light does not come on, wiggle the cover sideways to set the interlocks and try again. Adjust the beam current to about 80 μA by rotating the adjust screw at the left front of the unit with a small screw driver. NEVER MAKE THIS ADJUSTMENT WITHOUT THE MONITOR CONNECTED AND DO NOT EXCEED 80 μA UNLESS YOU HAVE CLEARED IT WITH THE INSTRUCTOR!

2. With a radiation survey meter, check the radiation level in the areas where you will be working. You will not be able to measure very close to the unit (within about 10 cm) because rf radiation from the x-ray power supply will paralyze the survey meter circuitry. Use the radioactive source provided with the survey meter to be sure the monitor is operating properly, then remove the source and measure the radiation level. IF THERE IS ANY QUESTION OF THE LEVEL OF SAFETY IN THE LABORATORY, DO NOT PROCEED FURTHER WITHOUT CONSULTING THE INSTRUCTOR!