RD-SBM20 Geiger Counter
Badger Technical LLC

Technical Data

1. Power supply: 6VDC by x4 AA batteries (internal)

    1. 4.75VDC minimum to 12VDC maximum
    2. ~32 mA current (backlight ON, background counts)
    3. ~90 hours operation (backlight ON, background counts)
    4. Current consumption will increase, and **operating hours will decrease, with increasing count rate**

2. Electronics: GK-Mini v1.5 by DIYGeiger

    1. https://sites.google.com/site/diygeigercounter/home/gk-mini
    2. 250k CPM max count rate (software limited)
    3. 144mR/hr max dose rate with SBM-20 tube (tube nominal maximum)

3. Tube: SBM-20 thin-wall gamma/beta

    1. Co-60 gamma scalar 1500 CPM/mR/hr
    2. Co-60 + Ra-226 gamma scalar 1754 CPM/mR/hr
    3. Cs-137 gamma scalar 1029 CPM/mR/hr
    4. Cs-137 beta scalar 129 CPM/mR/hr
    5. Each tube's scalars are individually determined, and are scribed into the BOTTOM of the counter, beneath the Beta Window. The 4-digit number is for gamma, 3 digit is for beta.
    6. Calibrated for mR/hr (millirem per hour). Dose rate conversion factor is 10uSv/hr per mR/hr.

Illustration 1: Beta Window swung aside, showing tube, s/n, and scalar locations. Cap screws are size M3.

Operation

1. Normal operation

Illustration 2: Switch locations and functions. Labels are on LEFT side of case

1. PWR: Power switch. Toggle to the LEFT (towards the label) to power on

2. BET GAM: Beta/gamma selector switch.

    1. Toggle to the LEFT (towards the label) and remove the beta window, to measure beta radiation from the BOTTOM of the counter.
    2. Toggle to the RIGHT (towards the screen) to measure gamma radiation, OMNIDIRECTIONAL.
    3. NOTE: If beta window is removed and switch is in GAMMA position, the counter will measure beta and gamma from the BOTTOM, and gamma OMNIDIRECTIONAL. Beta will be under-represented if present.
    4. NOTE: If beta window in installed (only gammas can reach the detector tube) and the switch is in BETA position, the counter will over-represent the gamma dose rate
    5. NOTE: The switch controls the scalar (adjustment factor) used to calculate dose rate. Selecting the incorrect switch position will result in incorrect readings

3. AUD: Audible function. Toggle to the LEFT will enable audible feedback (clicks or tone). Toggle to the RIGHT will mute.

4. ILUM: Illumination for LCD screen. Toggle to the LEFT will turn on the LCD backlight.

    1. When the backlight is turned on, power consumption is higher and battery will deplete slightly faster

2. Beta Window

    1. Removing the plastic Beta Window from the BOTTOM (four M3 socket screws) will allow detection of beta radiation, otherwise blocked
    2. With beta window closed/installed, only gamma radiation is measured, because gamma can penetrate the casing
    3. Switching the BET/GAM switch to the beta position will select the correct calibration factor (scalar) to read beta radiation
    4. If the BET/GAM switch is in the beta position while gamma is being read, the dose rate readout will be incorrect (too high)
    5. The BET/GAM switch does NOT affect the number of counts detected, just the dose rate calculation on the LCD screen

Illustration 3: Beta Window: Expose the tube inside, to measure beta radiation

3. Software functions and adjustments

    1. MENU enters configuration screens

        1. “+” and “-” buttons scroll through screens
        2. Keypad numbers to enter different values
        3. ARROW (“play”) key to save entered values
        4. Default values are: 5000, >4.85V, 4, OFF, 10000, 10, CPM, mR/h, 1000, (CALIBRATION FACTORS, are BET/GAM switch dependent), 1m
        5. MENU returns to normal mode

    2. TEST button toggles between CLICK and TONE mode

        1. TONE mode uses much more power
        2. Default is CLICK mode: Each count is annunciated by a single click

    3. Complete user's guide for GK-Mini software, including instructions for changing scalars and units, may be downloaded here:

        https://sites.google.com/site/diygeigercounter/home/gk-mini/gk-mini-downloads

Illustration 4: Manipulating software settings

4. Battery compartment & attachment point

Illustration 5: Battery well cover. Please use care with fasteners; case is 3D printed

Illustration 6: Attachment points for belt loop, MOLLE panel, etc. Please note case is 3D printed, and is NOT waterproof

5. Cautions & Warnings

    1. Device is **not** water/weatherproof
    2. High voltages (~400V) exist within case
    3. Case is 3D printed and not as robust as similar injection-molded case.
    4. “Tube saturation” can occur at high dose rates.

        1. Extended operation at saturated conditions will damage the detector tube
        2. **Dose rate reading will be zero and all counts will be MISSED by the tube, when the tube is saturated, whereas *actual dose rate will be high***, and beyond the indication range of the instrument.
        3. Do not operate (or turn off) the device if CPM approaches 250k CPM (250,000 counts per minute) and/or 142 mR/hr (software maximum dose rate).
        4. Turn off instrument if counts suddenly go to zero from a high value – the tube may be saturated.
        5. Seek shielding and/or distance from source(s) of radioactivity immediately if saturation occurs; **your cumulative dose will be unknown if remaining in a field too high** to measure

    5. Device is aligned and tested with Cs-137 beta/gamma source. Different radioisotopes will have different energies; this will affect the dose rate reading accordingly.
    6. Device is NOT calibration-certified, i.e., it does not have NIST or NRC calibration. The device is tested and scalars are tuned for indication at 4.5cm distance from a 1.0 uCi Cs-137 point source. Accuracy is **not guaranteed** but likely within <=+/-15%. NOT CERTIFIED FOR USE FOR OCCUPATIONAL EXPOSURE CONTROLS or other uses requiring calibration certification.
    7. Device is not EMP shielded. Maximum internal wiring length is <= 10 inches
    8. Current consumption will go up, and battery life will go down, as a function of count (dose) rate.

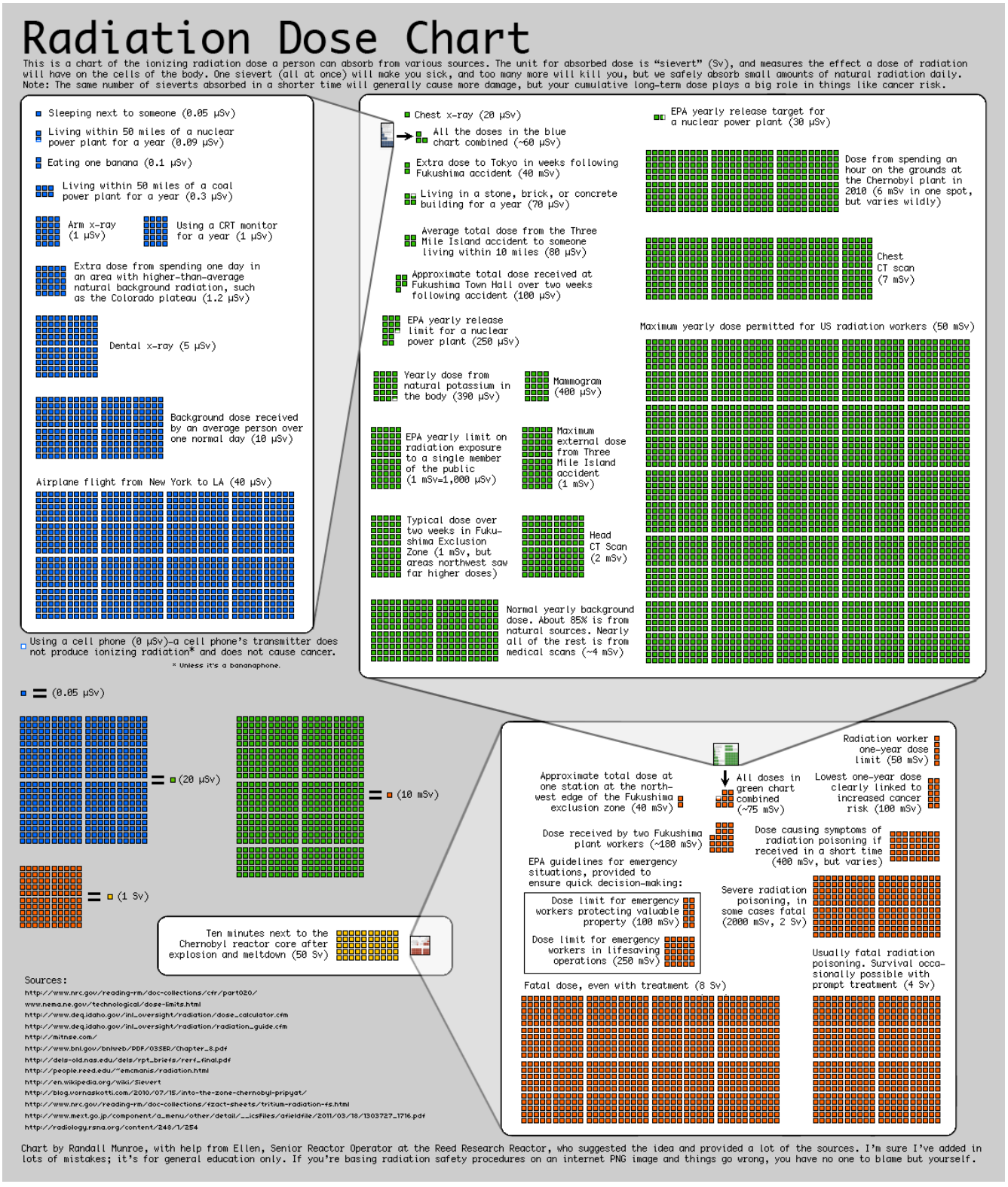

Illustration 7: Divide uSv dose rate by 10, for mR/hr dose rate unit. (10uSv/hr = 1mrem/hr, 10mSv/hr = 1R/hr, etc) 1 Sv = 100 REM = acute dose radiation poisoning effectively certain.