Cautions

- Authored by REMM and RITN physicians, this set of orders is a prototype only.
- **Orders must be customized for each patient and incident.**
- Specific drugs are suggested for function only. Patients may not need any/every category of drug listed.
- No HHS, CDC, FDA, or other US government entity endorsement of specific drugs or drug doses is intended or implied by inclusion in this order set.
- Consult the notes at the end of this document for additional, key information.

Internal contamination (decorporation treatments)

- This Adult and Pediatric Orders Prototype lists only FDA-approved medications as radioisotope countermeasures.
- Some, but not all of these drugs are currently in the Strategic National Stockpile.
- Prescribers should consult the FDA drug label for complete prescribing information.
- Decorporation drugs should be used in children with great caution.
- The online version of REMM has additional recommendations about additional countermeasure drugs that may be considered.
- This prototype does not address threshold levels of internal contamination that would trigger initiation, continuation, or discontinuation of decorporation treatment. See REMM Countermeasures Caution and Comment, which discusses this issue.

Drug dosages

- All adult drug doses in this prototype are based on a 70 kg adult with normal renal and hepatic function.
- Appropriate dose adjustments should be made based on age, weight, drug-drug interactions, nutritional status, renal, and hepatic function.
- All pediatric drug doses should be prescribed as appropriate for age, weight, and any clinical issues, including allergies.

- After a mass casualty incident, practitioners may encounter counterfeit drugs. This FDA website will provide information on avoiding and detecting counterfeit drugs and assist with reporting of suspected counterfeit medications.

- If this order set, **Version date 7/26/2013**, has been printed for use offline, consult the online version of REMM to see if updates are available. http://www.remm.nlm.gov/adultorderform.htm
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1. Administrative information

Name: ________________________________

Unique Identifier: _____________

Address: ________________________________

Phone: ________________

Spoken language: _____________

Unaccompanied minor: ___________

Next of kin contact information: ________________________________

Special needs: ___________________________________________________________________________

2. Admit to:

__ Hospital ward _____________ Area_______________

__ Team: _______________ ICU_______________

__ Physician: _______________ Other _______________

3. Diagnoses

Acute Non-radiation Related Admission Diagnoses:

a. ________________________________

b. ________________________________

c. ________________________________

d. ________________________________

e. ________________________________

f. ________________________________
Acute Radiation-related Admission Diagnoses

a. Radiation contamination? Yes_____ No_____

See REMM Body Chart (page 18) to record whole body radiation survey.

___ External contamination with Isotope (Specify or unknown) ____________
___ Internal contamination with Isotope (Specify or unknown) ____________
___ Contamination suspected, Isotope uncertain

b. Radiation Exposure / Acute Radiation Syndrome (ARS)?

Yes_____ No_____  
• Estimated whole body dose from exposure__________(units of gray)
• See also Item #23 for additional details

Other potential complicating factors

___ Mass casualty incident
___ Other, Specify __________________

Specific populations potentially requiring more customized management?

Yes_____ No_____  
___ Infant (< 1 y)
___ Child (1-16 y) __ Age > 65 y
___ Pregnant/Possibly pregnant __ Immunosuppressed
___ Other, Specify __________________

• See REMM page about At-Risk/Special Needs Populations
4. **Precautions:**

**Infectious**
- Contact
- Droplet
- Airborne
- Reverse Isolation/Neutropenic

**Radiation precautions**
- For persons with known or suspected *external or internal contamination*.
- Persons with *exposure* but NO *contamination* are NOT radioactive. Patients with exposure only do not need Radiation Precautions.

__ **Precautions:** Single room, gown, mask, cap, boots, and gloves__
__ Use medical facility procedures for discarding all biological/physical/radioactive waste, including linens/towels/trash/personal protective equipment. __
__ Contact Radiation Safety Officer for additional instructions. Phone: ______________ Page: ____________ __
__ Place Radiation Safety Sign on door if patient has internal or external radioactive contamination __
__ Notify pregnant staff that entry to room is prohibited if patient is/may be contaminated. __
__ Everyone entering room/area of contaminated patient must wear personal radiation dosimeter assigned by Radiation Safety. __
__ Use medical facility procedures for disposal of radiation waste, including linens/towels/trash/personal protective equipment. __

- **See guidance**
  - [Components of a Protective Environment](http://www.cdc.gov) (HHS/CDC)

5. **Urgent consultations: specify**

__ Pediatric Hematology/Oncology  __ Transfusion Medicine  
__ Adult Hematology / Oncology  __ Radiation Oncology
__ Hematopoietic Stem Cell Transplantation  __ Endocrinology  
__ Mental Health / Psychiatry  __ Pain Service
__ Ophthalmology  __ Gastroenterology
__ Dermatology / Plastic Surgery  __ Burn Therapy
__ Radiation Safety  __ Other ________________
6. Condition:

__ Good __ Fair __ Stable __ Guarded __ Critical

7. Vital Signs:

__ q 2 hours X 4 __ Ward routine
__ q 4 hours X 4

Notify physician for:
- Temperature _____> 38 °C _____ Other: ___________
- SBP: _____> 180, <100 _____ Other: ___________
- DBP: _____> 100, < 50 _____ Other: ___________
- HR: _____>100, <50 _____ Other: ___________
- RR: ______ >30<8 _____ Other: ___________
- O₂ saturation: _____< 92% _____ Other: ___________

8. Allergies:

__ No Known Drug Allergies (NKDA)
__ Allergies (drugs, foods)
If yes, specify: ______________________________________

9. Activity:

__ Bed rest __ Bathroom privileges
__ Out of bed every ___ hrs. __ Ambulate as tolerated
__ Confine to room

10. Diet:

__ Regular Diet __ Liquids (full, clear) __ NPO
__ Advance as tolerated
__ Neutropenic diet
__ Special dietary needs/requests: __________________________

11. Height, weight:

Height: ____ feet ____ inches or ____ cm
Weight: ____ lbs. ____ oz. or ____ Kg
Repeat body weight: q _____ hours q _____ days
12. **Age:**
Months (if <3 years) _____  Years _____

13. **IV fluid management:**

___ IV Fluids: _____ @ _____ cc/hr, with additive ______

___ IV Fluids: _____ @ _____ cc/hr, with additive ______

14. **Foley catheter management (specify) ________________**

___ Use radiation precautions for urine and feces for patients with internal radiation contamination.

15. **Monitor I / O**

Frequency __________

___ Use radiation precautions for urine and feces for patients with internal radiation contamination.

16. **Deep Venous Thrombosis (DVT) prophylaxis¹:**

___ TED hose to Bilateral Lower-Extremities

___ Sequential Compression Devices (SCD)

___ Anticoagulation regimen ________________________________

___ Other

**Note:** The potential benefit of anticoagulation (e.g. heparin¹,²) should be balanced against the risk of excessive bleeding in patients with severe thrombocytopenia or significant gastrointestinal toxicity.

17. **Respiratory Therapy:**

___ Use radiation precautions for personnel, equipment, and waste if patient has internal radiation contamination.

___ Room air   ___ Chest tube care (Specify)___________

___ Titrate oxygen supplementation for Oxygen saturation > ____%

___ Nebulizer treatment (Specify) __________________________

18. **Wound care¹:** (see also item 25)

___ Decontaminate external wounds if there is external contamination.

See REMM [contaminated wound](#) care recommendations.
__ Sterile dressing to wounds daily

__ Monitor waste

__ Use medical facility procedures for discarding biological/radioactive/physical waste and linens/towels/trash/personal protective equipment.

__ Radiation precautions (needed if patient has radiation contamination)

__ Silvadene (Silver Sulfadiazine) \(^2\) cream topically to burns

__ Bacitracin topically to burns

__ Other wound management per Burn team/Dermatology/Surgery:
Pager ______________  Phone ________________________

19. Orthopedic care:

__ Splint/brace/cast

__ Other orthopedic management procedure per orthopedics:
Pager ______________  Phone ________________________

20. Admission studies: Labs, Imaging

Labs

__ CBC w/differential

__ Comprehensive Metabolic Panel (CMP) / Chem 14

__ Cardiac enzymes

__ PT / PTT

__ Urinalysis

__ Urine culture

__ Blood culture

__ Urine HCG

__ Serum HCG

__ Thyroid Function Tests (Specify) _____________

Serologies:

__ Herpes Simplex Virus type 1 (HSV-1)

__ Herpes Simplex Virus type 2 (HSV-2)

__ Cytomegalovirus (CMV)

__ Varicella-zoster virus (VZV)
Imaging

__ Chest x-ray ______ PA/Lateral _________ Portable
__ Other imaging studies Specify: ________________________________

21. Standing labs / studies

__ CBC w/diff q ___ hours, x ___ days, Followed by q ___ until further orders
__ Comprehensive Metabolic Panel (CMP) / Chem 14
   Followed by q ____ hours, x ____ days
   Followed by q ____ until further orders

22. Electrocardiogram
__ Electrocardiogram
__ STAT Electrocardiogram for chest pain, notify physician

23. Radiation Dose Assessment

A. Biodosimetry and Bioassay assays
   • Difference between Biodosimetry and Bioassay
   • Define biodosimetry
   • More about biodosimetry
   • Dicentric chromosome assay

B. Biodosimetry assays for radiation exposure
   • See REMM information on
     ▪ Dose Estimator for Exposure: 3 biodosimetry tools
     ▪ Dose Reconstruction
   • Estimated whole body dose from exposure: _____ (Gray)
     Using which tool(s) ______________________________
     e.g., vomiting, lymphocyte depletion kinetics, dicentric chromosome assay
     Note: if different assays give different results
   • METREPOL Scores: Heme___ GI___ Neuro___Cutaneous____
   • Response Category (RC score) ____________
     Explain METREPOL
     Consider Response Category in clinical triage (Interactive tool for ARS)
   • Date of exposure: ____________
   • Time of exposure: ____________
   • Location of patient at time of exposure: ______________
   • Estimated whole body/partial body dose, specify _______ (dose)
   • Dose unknown: _______
Dicentric Chromosome Assay Instructions:
- Draw extra green top tube and provide: date ________   time _______
- See REMM for location of approved US laboratories that perform this test.
- Send this tube **ON ICE** for outside lab study
  - To the attention of: _____________________________________
  - Name of lab:_____________________________________
  - Address of lab:____________________________________

C. Radiation bioassay for evaluating/managing internal decontamination
- Collect ≥ 70 mL Spot urine for ____________(name of radioactive isotope)

  Note: Consult senior radiation event medical managers for name and location of other laboratories that may be available to perform this test in a mass casualty incident. Routine labs generally cannot perform this test.

24. Blood bank
   ___ Type and cross match
   ___ Type and screen

   For ____ units of packed red blood cells
   For ____ units of platelets

  Note:
  - Use only leukoreduced AND irradiated products, if available, unless it is known with certainty that the patient was exposed to a low dose of radiation, e.g. less than 100 cGy.
  - If radiation whole body dose is not known with certainty, leukoreduced AND irradiated products are preferred, if available.
  - See REMM blood use page for additional information.

25. General Medications¹:

   - Suggested dose ranges for pediatric patients (PEDS) are included for some but not all drugs.
   - Drug names are generally listed as follows Generic (Brand) names
   - Some drugs with **bold blue font** have DailyMed hyperlinks with additional information.

For gastric acid suppression:

   ___ Lansoprazole (Prevacid)² 15-30 mg PO daily
   PEDS: 1 mg/kg, max 30 mg/dose.
   Dose: ______
Prototype for Adult and Pediatric Medical Orders
During a Radiation Incident
Version 7/26/2013

For radiation-induced nausea & vomiting:

___ **Ondansetron** *(Zofran)* **2** 4 mg IV q 8h PRN nausea/ emesis
PEDS: 0.15 mg/kg, max 8 mg, IV/PO Q 8hrs PRN.
Dose: ______

___ **Lorazepam** *(Ativan)* **2** 0.5 mg – 1 mg PO q 6-8h
PRN anxiety/insomnia/breakthrough nausea
PEDS: 0.03 mg/kg IV/PO Q 6 hrs PRN.
Dose: ______

___ **Prochlorperazine** **2** 10 mg PO/IM/IV q 6-8h
PRN anxiety/insomnia/breakthrough nausea

See ASCO antiemetic guidelines for adults**3**:


See New England Journal of Medicine June 5, 2008 article: *Chemotherapy induced nausea and vomiting* **3**

- See National Comprehensive Cancer Network (NCCN) Antiemetic Guideline for Adults:

For fever:

___ **Acetaminophen** **2** 650 mg PO q 6 – 8h PRN temperature> 38 ºC
PEDS: 15 mg/kg, max 650 mg PO Q 6 hrs PRN. *(Tylenol)*
Dose: ______

For diarrhea:

___ **Loperamide hydrochloride** *(Imodium)* **2**:
  - Recommended initial dose is 4 mg (2 capsules) followed by 2 mg (1 capsule) after each unformed stool.
  - Daily dose should not exceed 16 mg (8 capsules)

For rash:

___ Topical sterile dressing

___ **Diphenhydramine hydrochloride** *(Benadryl)* **2** 25-50 mg PO q 4-6 hours for pruritis, not to exceed 300 mg/24 hours
PEDS: 1 mg/kg, max 50 mg IV/PO Q 6 hrs PRN.
Dose ______
For pain:

___ Morphine sulphate\(^2\) ___ mg ___ route ___ frequency

PEDS: 0.05-0.1 mg/kg IV Q 2 hrs PRN; 0.2-0.5 mg/kg PO Q 4 hrs PRN.
Dose ______

For skin burns: (see also item 18: wound care)

Burn topical regimen __________________________________________

Replace body fluid _____________________________________________

Other burn therapy ____________________________________________

For oral mucositis:

Mouth care regimen __________________________________________

---

26. Radioisotope decorporation or blocking agents:
- Note: Only FDA approved radiation countermeasures are listed in table below.
- See REMM Radiation Countermeasures for Treatment of Internal Contamination table for longer list of countermeasures which have been recommended by some experts but are not FDA approved as radiation countermeasures.

<table>
<thead>
<tr>
<th>Medical Countermeasure</th>
<th>Administered for</th>
<th>Route of Administration</th>
<th>Dosage</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca-DTPA(^2) (^4)</td>
<td>Americium (Am-241)(^2)</td>
<td>IV(^2): Give once daily as a bolus or as a single infusion, i.e., do not fractionate the dose.</td>
<td>IV: 1 g in 5 cc 5% dextrose in water (D5W) or 0.9% sodium chloride (normal saline, NS) slow IV push over 3-4 minutes OR 1 g in 100-250 cc D5W or NS as an infusion over 30 minutes</td>
<td>Ca-DTPA for the first dose Give Zn-DTPA for any follow-up doses (i.e., maintenance as indicated) Duration of therapy depends on total body burden and response to treatment</td>
</tr>
<tr>
<td>Zn-DTPA(^2) (^4)</td>
<td>Californium (Cf—252)(^3)</td>
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<tr>
<td>See REMM’s DTPA information.</td>
<td>Cobalt (Co-60)(^3)</td>
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<tr>
<td>See FDA’s Zn-DTPA drug label.</td>
<td>Curium (Cm-244)(^2)</td>
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<td></td>
</tr>
<tr>
<td>See FDA’s Ca-DTPA drug label.</td>
<td>Plutonium (Pu-238 and Pu-239)(^2)</td>
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<tr>
<td></td>
<td>Yttrium (Y-90)(^3)</td>
<td>Nebulized inhalation(^2): DTPA is FDA-approved for nebulized inhalation in adults only, and if</td>
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<th>Medical Countermeasure</th>
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<th>Route of Administration</th>
<th>Dosage</th>
<th>Duration</th>
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</thead>
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<tr>
<td>Potassium iodide&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Iodine (I-131)</td>
<td>PO</td>
<td>Adults &gt;40 years: 130 mg/day (for projected thyroid dose ≥ 500 cGy)</td>
<td>• Some incident will require only a single dose of KI. • Incident managers may recommend additional doses if ongoing radioactive iodine ingestion or inhalation represents a continuing threat. • See also: Potassium Iodide (KI): Duration of Therapy.</td>
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<td></td>
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<td>Adults 18-40 years: 130 mg/day (for projected thyroid dose ≥ 10 cGy)</td>
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<tr>
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<td></td>
<td>Pregnant or lactating women of any age: 130 mg/day (for projected thyroid dose ≥ 5 cGy)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>PEDS: 3-18 yrs: 65 mg/d 1 month – 3 yrs: 32.5 mg/d Birth-1 month: 16 mg/d</td>
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</tbody>
</table>

the route of contamination is through inhalation.

**Nebulized inhalation:** 1 g in 1:1 dilution with sterile water or NS over 15-20 min

**PEDS:** nebulized dosing same as adults

---

**Potassium iodide**

See REMM’s KI summary information.

See FDA’s KI information.
<table>
<thead>
<tr>
<th>Medical Countermeasure</th>
<th>Administered for</th>
<th>Route of Administration</th>
<th>Dosage</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prussian blue, insoluble(^2)</td>
<td>Cesium (Cs-137)</td>
<td>PO</td>
<td>Adults: 3 g PO tid (see FDA package insert) OR 1-3 g PO tid with 100-200 mL water, up to 10-12 g/day (based on Goiânia accident data) <strong>PEDS:</strong> &gt;12 yrs: 1-3 g po TID; 2-12 yrs: 1 gm TID</td>
<td>Minimum 30 days course per FDA; Obtain bioassay and whole body counting to assess treatment of efficacy; Duration of therapy depends on total body burden and response to treatment</td>
</tr>
<tr>
<td></td>
<td>Thallium (Tl-201)</td>
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See REMM’s Prussian Blue summary information.

See FDA’s Prussian Blue drug label.
27. Neutropenia therapy, if indicated:\textsuperscript{1, 5}:

**Neutropenia definition:**
a total count of neutrophils + bands in the peripheral blood <1,000 /µL

- Although the 3 drugs listed below are FDA-approved for the treatment of chemotherapy induced neutropenia, none is approved either for radiation-induced neutropenia or as prophylactic treatment prior to the onset of neutropenia.
- See additional REMM information on white cell growth factors/cytokines.
- In a mass casualty radiation event, use of these drugs would be off-label or require a formal Emergency Use Authorization.

### Myeloid cytokines

<table>
<thead>
<tr>
<th>Cytokine\textsuperscript{3}</th>
<th>Adult dose</th>
<th>Pregnant Women\textsuperscript{6}</th>
</tr>
</thead>
</table>
| G-CSF or filgrastim\textsuperscript{3} (Neupogen) | Subcutaneous administration  
  5 µg/kg/day via single daily injection  
  Continue until absolute neutrophil count > 1.0 x 10\textsuperscript{9} cells/L  
  **PEDS:** 5 µg/kg/day via single daily injection\textsuperscript{3} | Class C\textsuperscript{6} (Same as adults) |
| Pegylated G-CSF or pegfilgrastim\textsuperscript{3} (Neulasta) | 1 subcutaneous dose, 6 mg  
  Consider second 6 mg dose 7 or more days after initial dose, if significant neutropenia persists | Class C\textsuperscript{6} (Same as adults) |
| GM-CSF or sargramostim\textsuperscript{3} (Leukine) | Subcutaneous administration  
  250 µg/m\textsuperscript{2}/day  
  Continue until absolute neutrophil count > 1.0 x 10\textsuperscript{9} cells/L | Class C\textsuperscript{6} (Same as adults) |

**See Practice Guidelines for myeloid growth factors**

  See section entitled "NCCN Guidelines for Supportive Care".
- American Society of Clinical Oncology
For Antimicrobial prophylaxis with neutropenia:\(^1\):
- For patients with neutropenia who have NOT HAD NEUTROPENIC FEVER.
- Use as appropriate for each patient.
- Drugs listed are examples only.

**Anti-bacterial prophylaxis:**

- **Levofloxacin (Levaquin)**\(^2\) 500 mg PO/IV daily
  
  **Dose:** __________

**Anti-viral prophylaxis (neutropenia without fever)**

- **Acyclovir (Zovirax)**\(^2\) 400 mg PO q12h, or
- **Acyclovir (Zovirax)**\(^2\) 250 mg/m\(^2\) IV q12h
  
  **Dose:** __________

**Anti-fungal prophylaxis (neutropenia without fever)**

- **Fluconazole (Diflucan)**\(^2\) 400 mg PO/IV daily – beginning when absolute neutrophil Count (ANC) becomes < 1000
  
  **Dose:** __________

  or

- **Posaconazole (Noxafil)**\(^2\) 200 mg PO tid with food – beginning when absolute Neutrophil Count (ANC) becomes < 1000

**For treatment of neutropenia AND fever**(defined as T>38 °C while neutropenic)\(^1\)

**Anti-microbial work-up and therapy**

- **Blood cultures**
- **Urinalysis w/culture**
- **Sputum culture + sensitivity**
- **Chest x-ray**

- **Cefepime (Maxipime)**\(^2\) 2gm IV q 8h
  
  **Dose:** __________

- **Vancomycin (Vancocin)**\(^3\) 1gm IV q 12h –
  
  Consider if: suspected catheter-related infection, skin or soft tissue infection, pneumonia or hemodynamic instability.

  **Dose:** _____
Antifungal therapy
Consider one of the following\(^1\) if: fever > 72 hours on antibacterial therapy, evidence of fungal infection or hemodynamic instability.

__ Voriconazole (Vfend)\(^3\) 6mg/kg IV q12h for two doses, then 4 mg/kg IV q12h
   PEDS: 15 mg/kg IV Q8h
   Dose: ______

__ Caspofungin (Cancidas)\(^2\) 70 mg IV once then 50 mg IV daily
   PEDS: 70 mg/m\(^2\) IV once, then 50 mg/m\(^2\) IV daily
   (max dose 70 mg once then 50 mg daily)
   Dose: ___

__ Liposomal amphotericin B (Ambisome)\(^2\) 3 mg/kg/day IV over 1-4h
   PEDS: same dose
   Dose: ___

__ Amphotericin B lipid complex (Abelcet)\(^3\) 3 mg/kg/day IV over 1-4h
   PEDS: same dose
   Dose: ___

See Fever and Neutropenia Guidelines with cancer

NOTES

1. Suggested drugs are listed as representatives of a functional class, and no specific medication endorsement is implied. Dosages are based on a 70 kg adult with normal baseline renal and hepatic function. Appropriate dosage adjustments should be made based on age, weight, drug-drug interactions, nutritional status, renal and hepatic function, and any other patient-specific characteristics that may apply.

2. FDA approved for this indication

3. This drug is not approved by the FDA for this indication. If used, this would be an “off label use”, and physician discretion is strongly advised.

4. Ca-DTPA and Zn-DTPA have not been approved by FDA for treating internal contamination with californium, thorium, and yttrium. For initial treatment, Ca-DTPA is recommended, if available, within the first 24 hours after internal contamination. Zn-DTPA is preferred for maintenance after the first 24 hours, if available, due to safety concerns associated with prolonged use of Ca-DTPA.

5. When to initiate treatment with cytokines
   - Initiation of treatment should be strongly considered for victims who develop an absolute neutrophil count of < 0.500 x 10\(^9\) cells/L and are not already receiving colony-stimulating factor.
Evidence from animal studies indicates that outcomes may be improved if colony stimulating factors are administered as soon as possible after radiation exposure, and prior to the onset of neutropenia.

Although most therapy for ARS is directed at actual clinical signs and symptoms, some clinical effects of ARS can be anticipated and potentially mitigated, as with the use of prophylactic white cell cytokines. This prophylactic use is also off label.

Emergency Use Authorization will be required for use of cytokines for radiation induced neutropenia in a mass casualty setting.

See published guidelines links in section 24.

6. For pregnant women:

Experts in biodosimetry must be consulted.

Any pregnant patient with exposure to radiation should be evaluated by a health physicist and maternal-fetal specialist for an assessment of risk to the fetus.

Class C refers to U.S. Food and Drug Administration Pregnancy Category C, which indicates that studies have shown animal, teratogenic, or embryocidal effects, but there are no adequate controlled studies in women; or no studies are available in animals or pregnant women.
Body Chart for Recording Results of Radiation Survey