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 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.

- 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 adult order set, **Version date 4/17/2017**, has been printed for use offline, consult the online version of REMM to see if updates are available. https://www.remm.nlm.gov/adult-order.pdf
Prototype for Adult Medical Orders
During a Radiation Incident
Version: April 17, 2017

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1. Administrative information

Name: ________________________________

Unique Identifier: ____________

Address: ________________________________

Phone: ________________

Spoken language: ____________

Unaccompanied minor: _________

Date of Birth:_______________

Age (years: _____

Gender:________________________

Next of kin contact information (home phone, cell phone, email, or address):

________________________________________________________

2. Admit to:

__ Inpatient Service _____________    Area________________

__ Team: _______________      PICU____________________

__ Hem/Onc: _____________    Hematopoietic Stem Cell Transplantation: ____

__ Admitting Physician: _______________ Pager: ________________

__ Attending Physician: _______________ Pager: ________________

__ Other Physician: _______________ Pager: ________________
3. Diagnoses

Acute/Chronic 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 19) 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/Gy)
      • See also Item #24, page 11 for additional radiation details and work-up

Other potential complicating factors
   __ Mass casualty incident
   __ Other, Specify __________________

Specific populations potentially requiring more customized management?
   Yes____ No_____  
   __ Age > 65 y
   __ Pregnant/Possibly pregnant  Duration of Pregnancy (weeks): _______
__ Immunosuppressed

__ Other, Specify ___________________________________

- See REMM page about at-risk 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: ______________ Pager: ____________
__ 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
5. **Urgent consultations: specify**

___ Intensive Care ___ Transfusion Medicine
___ Hematopoietic Stem Cell Transplantation ___ Radiation Oncology
___ Mental Health / Psychiatry ___ Endocrinology
___ Ophthalmology ___ Palliative Care and Pain Service
___ Dermatology / Plastic Surgery ___ Gastroenterology
___ Radiation Safety ___ Burn Therapy
___ Surgery: ___General ___Trauma ___Thoracic ___ Orthopedics
___ Hepatology ___ Infectious Disease
___ Pulmonary ___ Plastic Surgery
___ Cardiology ___ Nephrology
___ ENT
___ 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/up to chair 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: ____ cm
    Weight: ____ kg
    Repeat body weight:
    q ____ hours               q ____ days

12. Admission studies: Labs
    __ CBC w/differential ___ w/ Platelet count
    __ Comprehensive Metabolic Panel (CMP) / Chem 14
    __ PT or INR/PTT/fibrinogen/TT
    __ Urinalysis - Collection method: _______________________
       __ Urine culture
       __ Blood culture - Collection method: _____________ Sets: _____________
       Type of culture: Bacteria, fungal, aerobic, anaerobic
       __ Sputum culture
    __ Urine HCG (for all girls ≥10 years or post-menarche, whichever is earlier)
    __ Serum HCG (for any girls ≥10 years or post-menarche, whichever is earlier)
__ Thyroid Function Tests (Specify) _____________

___ Wound cultures

**Serologies:**
___ Herpes Simplex Virus type 1 (HSV-1)
___ Herpes Simplex Virus type 2 (HSV-2)
___ Cytomegalovirus (CMV)
___ Varicella-zoster virus (VZV)
___ Epstein Barr Virus (EBV)

13. **Standing labs / studies**

___ CBC w/diff and platelets 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

___ Other __________ (specify test and frequency)

14. **Blood bank**
(May set institutional transfusion parameters, e.g.: PRBC transfusion for Hgb < (7 g/dl) and platelet count < 20000/micL unless otherwise specified by medical staff.)

___ Type and cross match

___ Type and screen

  For ____ units or ____ ml of packed red blood cells (~10-15 ml/kg)
  For ____ units or ____ ml of platelets (~5-10 ml/kg)

**Note:**
- Use only leukoreduced AND irradiated products, if available, unless it is known with certainty that the patient was exposed to allow 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.
15. Imaging

__ Chest x-ray  Urgency:_________
__ PA/Lateral  Urgency:_________
__ Portable  Urgency:_________
__ Other imaging studies    Specify: ________________  Urgency: _________

16. Electrocardiogram

__ Electrocardiogram
__ STAT Electrocardiogram for chest pain, notify physician

17. IV fluid management:

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

18. __ Foley catheter management (specify) _____________
   __ Use radiation precautions for urine and feces for patients with internal radiation contamination.

19. __ Monitor I / O
   Frequency  ____________
   __Use radiation precautions for urine and feces for patients with internal radiation contamination.

20. Deep Venous Thrombosis (DVT) prophylaxis:

__ TED hose to Bilateral Lower-Extremities
__ Sequential Compression Devices (SCD)
__ Anticoagulation regimen ______________________________
__ Other

Note: The potential benefit of any anticoagulation regimen (e.g. heparin) should be balanced against the risk of excessive bleeding in patients with severe thrombocytopenia or significant gastrointestinal toxicity.
21. 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) ________________________________

22. Wound care: (see also item 25)
__ Decontaminate external wounds if there is external radiation contamination. See REMM radiation 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) cream topically to burns

__ Bacitracin topically to burns

__ Plastic Surgery Consultation

__ Other wound management per Burn team/Dermatology/Surgery:
  Pager ____________ Phone ______________________

23. Orthopedic care:
__ Splint/brace/cast/crutches

__ Other orthopedic management procedure per orthopedics:
  Pager ____________ Phone ______________________
24. 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 laboratoriesthat 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)**
   - See directions for sample collection, labeling, packaging and shipping bioassay specimen to CDC bioassay lab: [https://emergency.cdc.gov/radiation/labinfo.asp](https://emergency.cdc.gov/radiation/labinfo.asp)

**Note:** Consult senior radiation event medical managers for name and location of other laboratories that may become available to perform this test in a large mass casualty incident. Routine labs generally cannot perform this test, although in large incidents, senior managers may announce special arrangements.
25. General Medications:

- 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**) 15-30 mg PO daily

For radiation-induced nausea & vomiting:

- **Ondansetron** (**Zofran**) 4-8 mg IV/PO q 8h PRN nausea/emasis
- **Lorazepam** (**Ativan**) 0.5 mg – 1 mg PO q 6-8h PRN anxiety/insomnia/breakthrough nausea
- **Prochlorperazine** 10 mg PO/IV/IM (if adequate platelets) q 6-8h PRN anxiety/insomnia/breakthrough nausea

See [REMM bibliography on treatment of nausea and vomiting](#)

For fever:

- **Acetaminophen** 650 mg PO q 6 – 8h PRN temperature > 38 °C

For diarrhea:

- **Loperamide hydrochloride** (**Imodium**) :
  - 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**) 25-50 mg PO q 4-6 hours for pruritis, not to exceed 300 mg/24 hours

For pain:

- **Morphine sulphate** ______ mg ______ route ______ frequency
- **Other pain medication** (specify): name, dose, route, frequency
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 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>
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</thead>
<tbody>
<tr>
<td>Ca-DTPA¹,³</td>
<td>Americium (Am-241)¹</td>
<td>IV¹:</td>
<td>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-DTPA¹,³</td>
<td>Californium (Cf-252)²</td>
<td>IV¹:</td>
<td>Give once daily as a bolus or as a single infusion, i.e., do not fractionate the dose.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cobalt (Co-60)²</td>
<td>IV¹:</td>
<td>DTPA is FDA-approved for intravenous Rx of known or suspected internal contamination with Am, Cm, and Pu only.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Curium (Cm-244)¹</td>
<td>IV¹:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plutonium (Pu-238 and Pu-239)¹</td>
<td>Nebulized inhalation¹: DTPA is FDA-approved for nebulized inhalation in adults only, and if the route of contamination is through inhalation.</td>
<td>Nebulized inhalation¹: 1 g in 1:1 dilution with sterile water or NS over 15-20 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yttrium (Y-90)²</td>
<td>Nebulized inhalation¹:</td>
<td></td>
<td></td>
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</table>
### Medical Countermeasure

#### Potassium iodide

**Administered for**: Iodine (I-131)

**Route of Administration**: PO

**Dosage**
- **Adults >40 years**: 130 mg/day (for projected thyroid exposure $\geq 500$ cGy)
- **Adults 18-40 years**: 130 mg/day (for projected thyroid exposure $\geq 10$ cGy)
- **Pregnant or lactating women of any age**: 130 mg/day (for projected thyroid exposure $\geq 5$ cGy)

**Duration**
- Some incidents 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 REMM page about duration.
- See FDA page about duration.

---

#### Prussian blue, insoluble

**Administered for**: Cesium (Cs-137), Thallium (Tl-201)

**Route of Administration**: PO

**Dosage**
- **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)

**Duration**
- 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
27. Neutropenia therapy ± antimicrobials

**Neutropenia definition:**
Total count of neutrophils + bands in the peripheral blood <1,000 /microL

- The 2 drugs listed below have been approved by the FDA for the indication of acute exposure to myelosuppressive doses of radiation
- See REMM cytokines page for much more detailed information, especially potential need for dose alterations during large mass casualty incidents when medical countermeasures may be scarce.

### Myeloid cytokines approved by the FDA for the indication of acute exposure to myelosuppressive doses of radiation

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>Adult dose</th>
</tr>
</thead>
</table>
| G-CSF or filgrastim (Neupogen® drug label) | - 10 mcg/kg/day as a single daily subcutaneous injection in adults and children  
- Continue administration daily until absolute neutrophil count remains greater than 1,000/mm³ (= 1.0 x 10⁹ cells/L) for 3 consecutive (daily) CBCs or exceeds 10,000/mm³ (= 10 x 10⁹ cells/L) after a radiation-induced nadir.  
- See REMM cytokines page for more information about potential dose alterations during large mass casualty incidents when medical countermeasures may be scarce. |
| Pegylated G-CSF or pegfilgrastim (Neulasta® drug label) | - Two doses, 6 mg each, administered subcutaneously one week apart.  
- A CBC should be obtained prior to administration of the second dose of Neulasta®. Subject matter experts recommend not administering the second dose if absolute neutrophil count is greater than 5,000/mm³ (= 5.0 x 10⁹ cells/L).  
- See REMM cytokines page for more information about potential dose alterations during large mass casualty incidents when medical countermeasures may be scarce. |
| GM-CSF or sargramostim (Leukine® drug label) | - This drug is in clinical use for various indications but is NOT approved by the FDA for the specific indication of acute exposure to myelosuppressive doses of radiation.  
- Although Leukine® has not been approved for this indication, CDC has filed a pre-EUA with the FDA to support the issuance of an EUA under a declared emergency. Leukine® has been added to the SNS as noted on the REMM web site.  
- See drug label for prescribing information.  
- See REMM cytokines page for more information about potential dose alterations during large mass casualty incidents when medical countermeasures may be scarce. |
See Clinical Practice Guidelines for Myeloid Cytokines (Adults)

- NCCN Clinical Practice Guidelines in Oncology, Myeloid Growth Factors, Version 2.2016. See section entitled "NCCN Guidelines for Supportive Care" > "Myeloid Growth Factors". (Registration required.)

For Antimicrobial prophylaxis (no fever) with neutropenia:
- 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) 500 mg PO/IV daily

Anti-viral prophylaxis (neutropenia without fever)
- Acyclovir (Zovirax) 400 mg PO q12h, or
- Acyclovir (Zovirax) 250 mg/m² IV q12h

Anti-fungal prophylaxis (neutropenia without fever)
- Fluconazole (Diflucan) 400 mg PO/IV daily – beginning when absolute neutrophil Count (ANC) becomes < 1000
  or
- Posaconazole (Noxafil) extended release tablets – 300 mg – one tablet twice daily day 1, then one tablet daily thereafter. Suspension is 200 mg TID– beginning when Absolute Neutrophil Count (ANC) becomes < 1000.

For treatment of neutropenia AND fever (defined as T>38 °C while neutropenic)
Anti-microbial work-up and therapy
__ Blood cultures    __ Urinalysis w/culture
__ Sputum culture + sensitivity  __ Chest x-ray

__ Cefepime (Maxipime) 2gm IV q 8h

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

  Consider trough level before 4th dose.

Antifungal therapy
  Consider one of the following if: fever >72 hours on antibacterial therapy, evidence of fungal infection or hemodynamic instability.

__ Voriconazole (Vfend) 6mg/kg IV q12h for two doses, then 4 mg/kg IV q12h
  Maintenance oral dose:  Weight <40 kg: 100 mg PO every 12 hours
  Weight ≥40 kg: 200 mg PO every 12 hours

__ Caspofungin (Cancidas) 70 mg IV once then 50 mg IV daily

__ Liposomal amphotericin B (Ambisome) 3 mg/kg/day IV over 1-4h
__ Amphotericin B lipid complex (Abelcet) 3 mg/kg/day IV over 1-4h

See REMM page on peer-reviewed  Fever and Neutropenia Guidelines
NOTES

1. FDA approved for this indication

2. 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.

3. 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.
Body Chart for Recording Results of Radiation Survey