Prototype for Adult and Pediatric Medical Orders During a Radiation Incident

Version 11/19/2012

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 11/19/2012**, 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**
  - 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings Healthcare Infection Control Practices Advisory Committee,
  - Components of a Protective Environment

5. Urgent consultations: specify

__ Pediatric Hematology/Oncology

__ Adult Hematology / Oncology

__ Hematopoietic Stem Cell Transplantation

__ Mental Health / Psychiatry

__ Ophthalmology

__ Dermatology / Plastic Surgery

__ Radiation Safety

__Other _____

__ Transfusion Medicine

__ Radiation Oncology

__ Endocrinology

__ Pain Service

__ Gastroenterology

__ Burn Therapy

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 ºC	_____ Other: _____
SBP: _____> 180, <100	_____ Other: _____
DBP: _____ > 100 < 50	_____ Other: _____
HR: _____>100 <50	_____ Other: _____
RR: _____ >30<8	_____ Other: _____
O_2 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) prophylaxis[1]:

__ TED hose to Bilateral Lower-Extremities

__ Sequential Compression Devices (SCD)

__ Anticoagulation regimen _____

__ Other

Note: The potential benefit of anticoagulation (e.g. **heparin**[1,2]) 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 care[1]: (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

- 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)
- Directions for sample collection, labeling, packaging and shipping bioassay specimen to CDC bioassay lab. http://www.bt.cdc.gov/radiation/labinfo.asp

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 alow 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 Medications[1]:

- 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: _____

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]:

- Basch E, et al. Antiemetics: American Society of Clinical Oncology Clinical Practice Guidelines Update, J ClinOncol 2011;29: *4189-4198*
- Kris MG, Kesketh PJ, et al.American Society of Clinical Oncology guideline for antiemetics in oncology: update 2006, J ClinOncol. 2006 Jun 20;24(18):2932-47

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:**
NCCN Guideline Version 1.2012[3]

For fever:

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

Medical Countermeasure	Administered for	Route of Administration	Dosage	Duration
Ca-DTPA[2,4] **Zn-DTPA**[2,4] See REMM's DTPA information. See FDA's Zn-DTPA drug label. See FDA's Ca-DTPA drug label.	Americium (Am-241)[2] Californium (Cf—252)[3] Cobalt (Co-60)[3] Curium (Cm-244)[2] Plutonium (Pu-238 and Pu-239)[2] Yttrium (Y-90)[3]	**IV**[2]**:** Give once daily as a bolus or as a single infusion, i.e., do not fractionate the dose. DTPA is FDA-approved for intravenous Rx of known or suspected internal contamination with Am, Cm, and Pu only. **Nebulized inhalation**[2]**:** DTPA is FDA-approved for nebulized inhalation in adults only, and if	**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	• 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

Medical Countermeasure	Administered for	Route of Administration	Dosage	Duration
		the route of contamination is through inhalation.	PEDS: <12 years old: 14mg/kg IV qd, no more than 1g/day **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[2] See REMM's KI summary information. See FDA's KI information.	Iodine (I-131)	**PO**	**Adults >40 years:** 130 mg/day (for projected thyroid dose ≥500 cGy) **Adults 18-40 years:** 130 mg/day (for projected thyroid dose ≥ 10 cGy) **Pregnant or lactating women** of **any age:** 130 mg/day (for projected thyroid dose ≥ 5 cGy) **PEDS:** **3-18 yrs:** 65 mg/d **1 month –3 yrs:** 32.5 mg/d **Birth-1 month:** 16 mg/d	• 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.

Medical Countermeasure	Administered for	Route of Administration	Dosage	Duration
Prussian blue, insoluble[2] See REMM's Prussian Blue summary information. See FDA's Prussian Blue drug label.	Cesium (Cs-137) Thallium (Tl-201)	**PO**	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) **PEDS:** **>12 yrs:** 1 – 3 g po TID; **2-12 yrs:** 1 gm TID	• 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, if indicated[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

Cytokine[3]	**Adult dose**	**Pregnant Women[6]**
G-CSF or filgrastim[3] (Neupogen)	• Subcutaneous administration • 5 µg/kg/day via single daily injection • Continue until absolute neutrophil count > 1.0 x 10^9 cells/L • **PEDS:** 5 µg/kg/day via single daily injection[3]	Class C[6] (Same as adults)
Pegylated G-CSF or pegfilgrastim[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[6] (Same as adults)
GM-CSF or sargramostim[3] (Leukine)	• Subcutaneous administration • 250 µg/m^2/day • Continue until absolute neutrophil count > 1.0 x 10^9 cells/L	Class C[6] (Same as adults)

See Practice Guidelines for myeloid growth factors

- **National Comprehensive Cancer Network**
- **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

PEDS: 16 mg/kg/day divided q12H NOT TO EXCEED ADULT DOSE
Dose: _____

Anti-viral prophylaxis (neutropenia without fever)

__ **Acyclovir (Zovirax)**[2] 400 mg PO q12h, or
__ **Acyclovir (Zovirax)**[2] 250 mg/m^2 IV q12h
PEDS: 250 mg/m^2 IV bid or 10 mg/kg IV bid
Dose: _____

Anti-fungal prophylaxis (neutropenia without fever)

__ **Fluconazole (Diflucan)**[2] 400 mg PO/IV daily – beginning when absolute neutrophil Count (ANC) becomes < 1000
PEDS: 5 mg/kg PO/IV daily, max 400 mg daily
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 ºC 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
PEDS: 50 mg/kg, max 2000 mg IV Q8h
Dose: _____

__ **Vancomycin (Vancocin)**[3] 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
PEDS: 15 mg/kg IV Q8h
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/m2 IV once, then 50 mg/m2 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)**[2] 3 mg/kg/day IV over 1-4h
PEDS: same dose
Dose: ___

See Fever and Neutropenia Guidelines with cancer:

- Freifeld AG, Bow EJ, Sepkowitz KA, et al: Clinical practice guideline for the use of antimicrobial agents in neutropenic patients with cancer: 2010 update by the Infectious Diseases Society of America. Clin Infect Dis 52(4):e56-e93, 2011.

- National Comprehensive Cancer Network: NCCN Clinical Practice Guidelines in Oncology: Prevention and Treatment of Cancer-Related Infections. Version 2.2011. http://www.nccn.org/professionals/physician_gls/pdf/infections.pdf.
- New ASCO guidelines expected in 2012

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