

Prototype for Adult Medical Facility Orders During a Radiation Event
Version 12/08/2009

Cautions

- Orders must be customized for each event and patient!
- Specific drugs are suggested for function only, and patients may not need any/every category of drug listed. Consult the notes at the end of this document.
- This Adult Orders Prototype lists only FDA-approved medications as radioisotope countermeasures for internal contamination; see page 9-10. These drugs are currently in the [Strategic National Stockpile](#). Prescribers should consult the FDA drug label for complete information.
- All dosages in this prototype are based on a 70 kg adult with normal renal and hepatic function. Appropriate dosage adjustments should be made based on age, weight, drug-drug interactions, nutritional status, renal and hepatic function. Pediatric doses are not referenced, except for Potassium Iodide.
- This Adult Orders 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](#) information that discusses this issue.
- After a mass casualty event, practitioners may encounter counterfeit drugs. This [FDA website](#) will provide information on avoiding and detecting counterfeit drugs and assist reporting of suspected counterfeit medications.
- See "Notes" at end of order list for additional information.

1. Administrative information

Name: _____

Unique Identifier: _____

Address: _____

Phone: _____

Spoken language: _____

Admit to:

___ Hospital ward _____ ___ Area _____

___ Team: _____ ___ ICU _____

___ Physician: _____ ___ Other _____

Next of kin contact information: _____

Special needs: _____

2. Diagnoses: Radiation, Other

___ **Radiation contamination: description**

- See REMM [Body Chart](#) (page 14) to record whole body radiation survey.

___ External contamination with Isotope (Specify) _____

___ Internal contamination with Isotope (Specify) _____

___ Contamination suspected, Isotope uncertain

___ **Radiation Exposure / Acute Radiation Syndrome (ARS)**

___ Date of exposure _____

___ Time of exposure _____

___ Location of patient at time of exposure _____

___ Estimated whole body/partial body dose, specify _____ (dose)

___ Dose unknown

- See REMM information on [Dose Reconstruction](#).

___ **Other potential complicating factors**

___ Combined injuries? e.g. burn, blast, fracture, other
Specify: _____

___ Mass casualty incident

___ Specific populations potentially requiring more customized management

See REMM [Specific Populations](#) page

___ Young age (e.g. children < 12-16 y) ___ Older age (e.g., those > 65 y)

___ Pregnant/Possibly pregnant ___ Immunosuppressed

___ History of prior significant chronic disease(s) or conditions.

Specify each, including meds or special needs required for each:

___ Precautions

- ___ Contact
- ___ Droplet
- ___ Airborne
- ___ External Radiation
- ___ Internal Radiation
- ___ Reverse/Neutropenic

Urgent Consultations as indicted:

- | | |
|---|--------------------------|
| ___ Hematopoietic Stem Cell Transplantation | ___ Radiation Oncology |
| ___ Hematology / Oncology | ___ Transfusion Medicine |
| ___ Mental Health / Psychiatry | ___ Endocrinology |
| ___ Ophthalmology | ___ Pain Service |
| ___ Dermatology / Plastic Surgery | ___ Gastroenterology |
| ___ Radiation Safety | ___ Burn Therapy |

3. Condition:

___ Good ___ Fair ___ Stable ___ Guarded ___ Critical

4. Vital Signs:

- ___ q 2 hours X 4
- ___ q 4 hours X 4
- ___ Ward routine

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Notify physician for:

- Temperature > 38.5 °C
- SBP > 180, <100
- DBP > 100 < 50
- HR >100 <50
- RR >30 <8
- O₂ saturation < 92%

5. Special orders for patients with radiation contamination:

Radiation precautions

Use radiation precautions unless patient is known with certainty to have had only external exposure to radiation.

- Universal precautions with gown, mask, cap, boots, and gloves
- Use medical facility procedures for discarding 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.

6. Allergies:

No Known Drug Allergies (NKDA)

Allergies (drugs, foods)

If yes, specify: _____

7. Activity:

Bed rest

Bathroom privileges

Out of bed every ____ hrs.

Ambulate as tolerated

8. Diet:

Regular Diet Liquids (full, clear) NPO

Advance as tolerated

Neutropenic diet

Other _____

Special dietary needs/requests _____

9. Height, weight, age:

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Height: ___ feet ___ inches
 ___ cm

Weight: ___ lbs ___ oz
 ___ kg

Age: ___ years

Repeat body weight:
q ___ hours
q ___ days

10. Peripheral IV management:

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

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

11. ___ Foley catheter management

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

12. ___ Monitor I / O

Frequency _____

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

13. Deep Venous Thrombosis (DVT) prophylaxis¹:

___ TED hose to Bilateral Lower-Extremities

___ Sequential Compression Devices (SCD)

___ Anticoagulation regimen _____

___ Other

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.

14. Respiratory Therapy: (Radiation precautions needed if patient is contaminated.)

___ Room air ___ Chest tube care (Specify) _____

___ Titrate oxygen supplementation for Oxygen saturation > ___%

___ Nebulizer treatment (Specify) _____

15. Wound care¹: (see also item 22: burn therapy)

___ Decontaminate external wounds if there is external contamination.
See REMM [contaminated wound](#) care recommendations.

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- 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 is contaminated.
- Silvadene ([Silver Sulfadiazine](#))²** cream topically to burns
- Other wound management per Burn team/Dermatology/Surgery:
Pager _____ Phone _____

16. Orthopedic care:

- Splint/brace/cast
- Other orthopedic management procedure per orthopedics:
Pager _____ Phone _____

17. Admission labs / imaging studies / other:

- CBC w/differential
- Comprehensive Metabolic Panel (CMP) / Chem 14
- Cardiac enzymes
- PT / PTT
- Urinalysis
- Urine culture
- Blood culture x 2
- 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)
- Electrocardiogram
- Chest x-ray _____ PA/Lat _____ Portable
- Other imaging studies Specify: _____

18. Standing labs / studies:

CBC w/diff q ____ hours, x ____ days,
Followed by q ____ hours until further orders

Comprehensive Metabolic Panel (CMP) / Chem 14
Followed by q ____ hours, x ____ days
Followed by q ____ days

19. Electrocardiogram

Electrocardiogram
 STAT Electrocardiogram for chest pain, notify physician

20. Biodosimetry/Bioassay tests: See REMM's [Explaining Biodosimetry](#).

For biodosimetry: See REMM for more on the [Dicentric chromosome assay](#).

Dicentric Chromosome Assay: Draw extra green top tube on:
date _____ time _____
Send this tube **ON ICE** for outside lab study
To the Attention of: _____
Name of Lab: _____
Address of Lab: _____
See REMM for location of [laboratories that perform this test](#).

For Bioassay: tests evaluating/managing internal decontamination:

Spot urine for _____ name of radioactive isotope
 24-hour urine for _____ name of radioactive isotope
 Spot fecal specimen for _____ name of radioactive isotope
 24-hour fecal specimen for _____ name of radioactive isotope
Send specimen to: _____
Special requirements for containment, labeling, and shipping of specimen:

Note: Consult senior radiation event medical managers for name and location of specialized laboratories if your facility cannot perform these assays.

21. Type and screen

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

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- 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 dose is not known with certainty, leukoreduced AND irradiated products are preferred, if available.
- See [REMM blood use page](#) for additional information.

22. General Medications¹:

For gastric acid suppression:

___ **Lansoprazole ([Prevacid](#))²** 15-30 mg PO daily

For radiation-induced nausea & vomiting:

___ **Ondansetron ([Zofran](#))²** 4 mg IV q 8h PRN nausea/emesis

___ **Lorazepam ([Ativan](#))²** 0.5 mg – 1 mg PO q 6-8h PRN
anxiety/insomnia/breakthrough nausea

- See [American Society of Clinical Oncology 2006 Anti-emetic Guidelines³](#)
- See NEJM June 5, 2008 article: [chemotherapy induced nausea and vomiting³](#)

For Fever:

___ **[Acetaminophen \(Tylenol\)](#)²** 650 mg PO q 6 – 8h PRN temperature > 38 °C

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 constipation:

___ **Senna ([Senokot](#))²** 2 tabs PO BID, hold for loose stools

___ **Docosate ([Colace](#))²** 100 mg PO BID, hold for loose stools.
Per FDA monograph: 50 to 360 mg QD or divided BID for adults

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

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For pain:

__ Morphine sulphate² ____ mg ____ route ____ frequency

For skin burns: (see also item 15: wound care)

Burn topical regimen _____

Replace body fluid _____

Other burn therapy _____

For oral mucositis:

Mouth care regimen _____

23. For radioisotope decorporation or blocking:

- Note: Only FDA approved radiation countermeasures are listed in table below.
- See [REMM Countermeasures Table](#) for longer list of countermeasures which have been recommended by some experts but are not FDA approved as radiation countermeasures.

| Medication | Administered for which Isotopes | Route of Administration & Dosage for adults | 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. | Plutonium-239 ² Americium-241 ² Curium-244 ² Californium-252 ³ Thorium-232 ³ Yttrium-90 ³ | IV²: (for Zn or Ca) 1 g in 250 mL NS or 5% glucose, given in 1-2 h, or bolus over 3-4 min; given once initially and no more than once daily Nebulized inhalation²: 1g in 1:1 dilution with water or NS over 15-20 min | Up to 5 days |

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| Medication | Administered for which Isotopes | Route of Administration & Dosage for adults | Duration |
|---|---------------------------------|---|---|
| <p>Potassium iodide²</p> <p>See REMM's KI summary information.</p> <p>See FDA's KI information.</p> | <p>Iodine-131</p> | <p>PO:</p> <p>Adults >40 years of age with thyroid exposure ≥ 500 cGy: 130 mg/d</p> <p>Adults 18-40 years of age with thyroid exposure ≥ 10 cGy: 130 mg/d</p> <p>Pregnant or lactating women with thyroid exposure ≥ 5 cGy: 130 mg/d</p> <p>Children and adolescents 3-18 with thyroid exposure ≥ 5 cGy: 65 mg/d</p> <p>Adolescents approaching adult size (70 kg) should receive full adult dose of 130 mg).</p> <p>Infants 1 month to 3 years with thyroid exposure ≥ 5 cGy: 32.5 mg/d</p> <p>Neonates from birth to 1 month with thyroid exposure ≥ 5 cGy: 16 mg/d</p> | <ul style="list-style-type: none"> • In some incidents only a single dose of KI is required. • Incident Managers may recommend additional daily doses if radioactive iodine ingestion (or inhalation) is a continuing threat. • In some incidents, a course of 7-14 days may be recommended. |

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| Medication | Administered for which Isotopes | Route of Administration & Dosage for adults | Duration |
|---|-------------------------------------|---|---|
| <p>Prussian blue²</p> <p>See REMM's Prussian Blue information.</p> <p>See FDA's Prussian Blue drug label.</p> | <p>Cesium-137, Thallium-201</p> | <p>Adults: 0.5 g insoluble Prussian Blue per capsule</p> <ul style="list-style-type: none"> • 1 - 3 g PO tid with 100-200 mL water, up to 10-12 g/d (based on Goiânia accident data) • 3 g PO tid (see FDA drug label) <p>Children: 0.5 g insoluble Prussian Blue per capsule</p> <ul style="list-style-type: none"> • Age 2-12 years: 1 g PO tid • Capsules may be opened and mixed with food • FDA drug label contains pediatric information • Age <2 years: not FDA approved (IND or EUA may be required) | <p>≥3 weeks, titrated by urine and/or fecal radionuclide bioassay and whole-body counting</p> |

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24. Neutropenia therapy, if indicated^{1, 5}:

- 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.
- In a mass casualty radiation event, use of these drugs would require a formal [Emergency Use Authorization](#).
- Consult drug label in links below for each drug.
- See additional REMM information on [white cell growth factors/cytokines](#).

| Cytokine ³ | Adult dose | Pregnant Women ⁶ |
|---|---|--|
| G-CSF or filgrastim ³ (Neupogen) | <ul style="list-style-type: none"> • Subcutaneous administration • 5 ug/kg/day via single daily injection • Continue until absolute neutrophil count > 1.0 x 10⁹ cells/L | Class C ⁶ (Same as adults) |
| Pegylated G-CSF or pegfilgrastim ³ (Neulasta) | <ul style="list-style-type: none"> • 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) | <ul style="list-style-type: none"> • Subcutaneous administration • 250 ug/m²/day • Continue until absolute neutrophil count > 1.0 x 10⁹ cells/L | Class C ⁶ (Same as adults) |

See Practice Guidelines for myeloid growth factors

- [National Comprehensive Cancer Network](#)
- [American Society of Clinical Oncology](#)

Antimicrobial therapy¹:

- Use as appropriate for each patient.
- Drugs listed are examples only.

Anti-bacterial

___ Levofloxacin ([Levaquin](#))² 500 mg PO/IV qd

Anti-viral

___ Acyclovir ([Zovirax](#))² 400 mg PO q12h, or
 ___ Acyclovir ([Zovirax](#))² 250 mg/m² IV q12h

Anti-fungal

___ Fluconazole ([Diflucan](#))² 400 mg PO/IV daily – beginning when absolute neutrophil Count (ANC) becomes < 1000, or
 ___ Posaconazole ([Noxafil](#))² 200 mg PO tid with food – beginning when absolute Neutrophil Count (ANC) becomes < 1000

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25. Fever and Neutropenia¹

- | | |
|--|--------------------------|
| ___ Blood cultures x 2 sets | ___ Urinalysis w/culture |
| ___ Sputum culture + sensitivity | ___ Chest x-ray |
| ___ Cefepime (Maxipime)² 2 gm IV q 8h (use as appropriate) | |
| ___ Vancomycin (Vancocin)³ 1gm IV q 12h, check peak and trough level before the 4th dose | |

See current Neutropenia Guidelines from

- [IDSA](#) Infectious Diseases Society of America
- [ASCO](#) American Society of Clinical Oncology

Consider using one of the following¹:

- ___ **Liposomal amphotericin B (Ambisome)²** 3mg/kg/day IV over 1-4h
- ___ **Amphotericin B lipid complex (Abelcet)²** 3mg/kg/day IV over 1-4h
- ___ **Voriconazole (Vfend)³** 6mg/kg IV q 12h for two doses, then 4mg/kg IV q 12h
- ___ **Caspofungin (Cancidas)²** 70mg IV once then 50mg IV q 24h

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 $< 0.500 \times 10^9$ 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.

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- 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

