

Prototype/Template for Adult Hospital Orders During a Radiation Incident

Version: June 26, 2018

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>

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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: _____

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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): _____

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___ 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**

- [2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings](#), Healthcare Infection Control Practices Advisory Committee (HHS/CDC)

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5. Urgent consultations: specify

- | | |
|---|---|
| <input type="checkbox"/> Intensive Care | <input type="checkbox"/> Transfusion Medicine |
| <input type="checkbox"/> Hematopoietic Stem Cell Transplantation | <input type="checkbox"/> Radiation Oncology |
| <input type="checkbox"/> Mental Health / Psychiatry | <input type="checkbox"/> Endocrinology |
| <input type="checkbox"/> Ophthalmology | <input type="checkbox"/> Palliative Care and Pain Service |
| <input type="checkbox"/> Dermatology / Plastic Surgery | <input type="checkbox"/> Gastroenterology |
| <input type="checkbox"/> Radiation Safety | <input type="checkbox"/> Burn Therapy |
| <input type="checkbox"/> Surgery: <input type="checkbox"/> General <input type="checkbox"/> Trauma <input type="checkbox"/> Thoracic <input type="checkbox"/> Orthopedics | |
| <input type="checkbox"/> Hepatology | <input type="checkbox"/> Infectious Disease |
| <input type="checkbox"/> Pulmonary | <input type="checkbox"/> Plastic Surgery |
| <input type="checkbox"/> Cardiology | <input type="checkbox"/> Nephrology |
| <input type="checkbox"/> ENT | |
| <input type="checkbox"/> 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
SBP: _____ > 180, < 100
DBP: _____ > 100 < 50
HR: _____ > 100 < 50
RR: _____ > 30 < 8
O₂ saturation: _____ < 92%

- | |
|--------------------|
| _____ Other: _____ |
| _____ Other: _____ |
| _____ Other: _____ |
| _____ Other: _____ |
| _____ Other: _____ |
| _____ Other: _____ |

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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)

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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.

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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.

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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 _____

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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 [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)
- See directions for sample collection, labeling, packaging and shipping bioassay specimen to CDC bioassay lab: <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.

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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/emesis

___ **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

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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.**

Medical Countermeasure	Administered for	Route of Administration	Dosage	Duration
Ca-DTPA^{1,3} Zn-DTPA^{1,3} See REMM's DTPA information. See FDA's Zn-DTPA drug label. See FDA's Ca-DTPA drug label.	Americium (Am-241) ¹ Californium (Cf-252) ² Cobalt (Co-60) ² Curium (Cm-244) ¹ Plutonium (Pu-238 and Pu-239) ¹ Yttrium (Y-90) ²	IV¹: 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 inhalation¹: DTPA is FDA-approved for nebulized inhalation in adults only, and if the route of contamination is through inhalation.	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 Nebulized inhalation: 1 g in 1:1 dilution with sterile water or NS over 15-20 min	<ul style="list-style-type: none"> • 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

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Medical Countermeasure	Administered for	Route of Administration	Dosage	Duration
<p>Potassium iodide¹</p> <p>See REMM's KI summary information.</p> <p>See FDA's KI information.</p>	<p>Iodine (I-131)</p>	<p>PO</p>	<p>Adults >40 years: 130 mg/day (for projected thyroid exposure ≥500 cGy)</p> <p>Adults 18-40 years: 130 mg/day (for projected thyroid exposure ≥ 10 cGy)</p> <p>Pregnant or lactating women of any age: 130 mg/day (for projected thyroid exposure ≥ 5 cGy)</p>	<ul style="list-style-type: none"> • 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.
<p>Prussian blue, insoluble¹</p> <p>See REMM page on Prussian Blue</p> <p>See FDA Prussian Blue information page.</p> <p>See FDA's Prussian Blue drug label.</p>	<p>Cesium (Cs-137)</p> <p>Thallium (TI-201)</p>	<p>PO</p>	<p>Adults: 3 g PO tid (See FDA package insert)</p> <p>OR</p> <p>1 - 3 g PO tid with 100-200 mL water, up to 10-12 g/day (based on Goiânia accident data)</p>	<ul style="list-style-type: none"> • 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

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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

Cytokine	Adult dose
<p style="text-align: center;">G-CSF or filgrastim (Neupogen® drug label)</p>	<ul style="list-style-type: none"> • 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.
<p style="text-align: center;">Pegylated G-CSF or pegfilgrastim (Neulasta® drug label)</p>	<ul style="list-style-type: none"> • 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.
<p style="text-align: center;">GM-CSF or sargramostim (Leukine® drug label)</p>	<ul style="list-style-type: none"> • A subcutaneous injection administered once daily as follows: • 7 mcg/kg in adult and pediatric patients weighing greater than 40 kg • 10 mcg/kg in pediatric patients weighing 15 kg to 40 kg • 12 mcg/kg in pediatric patients weighing less than 15 kg • Continue administration of Leukine until absolute neutrophil count remains greater than 1,000/mm³ (= 1.0 x 10⁹ cells/L) for 3 consecutive 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.

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See Clinical Practice Guidelines for Myeloid Cytokines (Adults)

- Smith TJ, Bohlke K, Lyman GH, Carson KR, Crawford J, Cross SJ, Goldberg JM, Khatcheressian JL, Leighl NB, Perkins CL, Somlo G, Wade JL, Wozniak AJ, Armitage JO. [Recommendations for the Use of WBC Growth Factors: American Society of Clinical Oncology Clinical Practice Guideline Update](#). (2015 ASCO guideline) J Clin Oncol. 2015 Oct 1;33(28):3199-212. [PubMed Citation] (This 2015 ASCO guideline updates the [2006 myeloid cytokine guideline](#))
 - [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.)
 - Dainiak N, Gent RN, et al. [First Global Consensus for Evidence-Based Management of the Hematopoietic Syndrome Resulting From Exposure to Ionizing Radiation](#). Disaster Med Public Health Prep. 2011 Oct;5(3):202-212. [PubMed Citation] ([Full text](#))
-

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)

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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](#)

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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.

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Body Chart for Recording Results of Radiation Survey

