

Transportation Emergency Preparedness Program

Emergency Responder Radioactive Material Quick Reference Sheet

Initial Response/Scene Size Up

From a distance, try to identify the following:

- Spills, leaks, or fire
- Any victims needing rescue
- Type of vehicle and packages involved
- Placards, labels, or package markings
- Container/package damage
- Any person knowledgeable of the scene
- Location of shipping papers
- Proper protective clothing needed for entry

For radioactive materials, establish an **initial isolation zone of 75 feet** in all directions. Priorities for rescue, life-saving, first aid, fire control and other hazards are higher than the priority for measuring radiation levels. Attempt to detain uninjured personnel who may be contaminated until they can be surveyed by local Radiation Authority.

Vehicle Placards

Standard Placard



Vehicle placarding is required when transporting:

- One or more packages with a Yellow-III label
- Exclusive use shipments of LSA/SCO materials
- HRCQ shipments (see placard below)

Highway Route Controlled Quantity (HRCQ) Placard



HRCQ is a high activity shipment transported in a Type B package. The package will always have a Yellow-III label regardless of radiation level. HRCQ shipments by highway will require the standard placard on a white square background with a black border as shown at left.



Package Labels

Radioactive White-I

Expect up to 0.5 mrem/hr at surface of package.

No Transport Index associated with this label.



Radioactive Yellow-II

Expect > 0.5 mrem/hr up to 50 mrem/hr at surface of package.

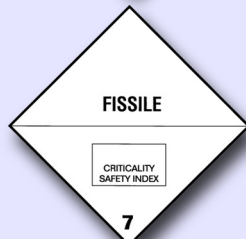
Maximum Transport Index is 1 or 1 mrem/hr at 1 meter.



Radioactive Yellow-III

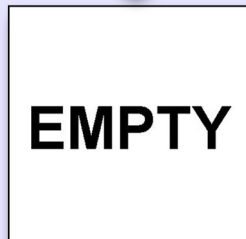
Expect > 50 mrem/hr up to 200 mrem/hr* at surface of package.

Maximum Transport Index is 10 or 10 mrem/hr at 1 meter.*



Fissile Label

For packages containing fissile material, this label will appear with one of the three labels shown above. Criticality Safety Index on label is used by shipper to limit the number of packages on a conveyance.



EMPTY Label

For packages that previously contained radioactive material (e.g., Type B Packages) and have been emptied of their contents. Package may still contain internal contamination. Expect < 0.5 mrem/hr at surface of package.

* May read up to 1,000 mrem/hr at package surface and up to 10 mrem/hr at 2 meters (6.6 feet) if package is transported in a closed transport vehicle under exclusive use provisions. Shipping papers will denote "exclusive use."

Shipping Paper Information

Look for the following information on shipping papers for radioactive material:

- Emergency response telephone number
- Proper Shipping Name and UN ID
- Name of radionuclide(s) (e.g., Cs-137)
- Radioactivity level per package in MBq, GBq, etc. (will be listed as "activity")
- Category of label applied (i.e., White-I, Yellow-II, Yellow-III)
- Transport Index (for Yellow-II and Yellow-III labeled cargo only)
- The letters "RQ" if material is a Reportable Quantity of hazardous material
- Package Type (e.g., IP, Type A, Type B)
- Physical & chemical form of material (if not special form)
- "Fissile Excepted" or Criticality Safety Index (for fissile materials only)
- "Exclusive use" if shipment is being made under exclusive use provisions
- Highway Route Controlled Quantity or "HRCQ" (if shipment is HRCQ)

Common Prefixes

The activity level shown on shipping papers and on the radioactive label is required to be listed in **becquerel**. The becquerel (Bq) is a quantity of radioactivity. The Bq is a very small amount of activity; equal to 1 nuclear disintegration per second. Because a becquerel is such a small amount of activity, prefixes are often used to change the size of the unit. For example 2.2 MBq denotes 2.2 million Bq or 2.2 million disintegrations per second. Many of the commonly used prefixes are shown in the table below.

Symbol	Prefix Value
k	kilo = 1 thousand
M	Mega = 1 million
G	Giga = 1 billion
T	Tera = 1 trillion
P	Peta = 1 quadrillion

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Radiological Protection Principles

Radiation is energy and cannot be detected by the human senses. A radiological survey conducted with specialized equipment is the only way to confirm the presence of radiation. Radiation survey instruments typically measure in units of $\mu\text{R}/\text{hour}$, mR/hour , or R/hour .

Contamination is radioactive material in an unwanted location (e.g., deposited on surfaces, skin, or clothing). Internal contamination can occur when radioactive material is inhaled, ingested, or lodged in an open wound. Contamination should not be suspected unless radioactive material packages are damaged and/or you suspect they have been breached. Contamination survey instruments typically measure in units of counts per minute (CPM) or kilo counts per minute (kCPM).

Decontamination involves removing radioactive material contamination from personnel or equipment. Remember that patient treatment takes priority over radiological controls.

For life-threatening injuries, decontamination is not a priority. Implement contamination controls as the situation allows but do not delay patient care or treatment. Attempt to contain contamination on patient using a blanket or sheet and notify the hospital of possible contamination as soon as possible.

For non life-threatening injuries where you suspect the patient may be contaminated:

- Carefully cut away and remove patient's outer clothing
- Treat injuries as necessary
- Package patient using double blanket method to help contain any possible contamination
- Notify hospital of possible contamination as soon as possible

Responder Safety involves wearing proper PPE and minimizing radiation exposure:

- Minimize time in radiological area
- Maximize distance from radiation sources
- Place shielding between you and source of radiation (e.g., vehicle)



This Quick Reference Sheet was produced by the
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For additional information, visit the TEPP website at:
www.em.doe.gov/otem
or phone (208) 528-8895



Guidelines for Control of Emergency Exposures

Adapted from:
EPA-400/R-17/001

Dose Limit	Activity Performed	Condition
5 rem	All occupational exposures	All reasonably achievable actions have been taken to minimize dose
10 rem	Protecting critical infrastructure	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
25 rem	Lifesaving or protection of large populations	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
>25 rem	Lifesaving or protection of large populations	All conditions above and only for people fully aware of the risks involved

Fissile Material: Except for natural/depleted uranium, any material containing U-233, U-235, Pu-239 or Pu-241. Fissile material packages requiring criticality controls will have the fissile label.

Industrial package: Designed for shipments of low activity material and contaminated objects, which are usually categorized as radioactive waste. They contain non life-endangering amounts of radioactive material. There are three categories of industrial packages: IP-1, IP-2, and IP-3.

LSA/SCO: Low Specific Activity (LSA) material means the radioactive material is distributed throughout a substance to such an extent that it poses little hazard if released in an accident. Surface Contaminated Object (SCO) means a solid object which is not itself radioactive but has radioactive material distributed on its surface. Examples include contaminated tools/equipment.

Rem: A measurement unit of radiation dose. Rem measures the amount of damage to human tissue from ionizing radiation. 1 μrem is one-millionth of a rem; 1 mrem is one-thousandth of a rem. The average member of the general population receives about 620 mrem (0.62 rem) annually.

Special Form: Radioactive material in an accident-tested, non-dispersible form.

Transport Index (TI): Determined by taking the maximum radiation level (as measured in mrem/hr) at one meter (3.3 feet) from an undamaged package. The TI will be found on Yellow II and Yellow III labels, and shipping papers when required.

Type A package: Designed to survive normal transport conditions (minor mishaps and rough handling). Type A packages contain non life-endangering amounts of radioactive material.

Type B package: Designed to survive severe accidents conditions. Life threatening conditions may exist only if contents are released or if package shielding fails. The designations "(U)" or "(M)" (e.g., Type B (U) or Type B (M) Package) refer to unilateral (U) or multilateral (M) approval of the package design.

Gamma Dose Rate	Stay Time Table				
	Stay time to receive this dose				
	1 rem	5 rem	10 rem	25 rem	100 rem
1 mR/hour	6 weeks	30 weeks	1 year	–	–
5 mR/hour	200 hours	6 weeks	12 weeks	30 weeks	2 years
100 mR/hour	10 hours	50 hours	100 hours	250 hours	6 weeks
1 R/hour	1 hour	5 hours	10 hours	25 hours	100 hours
10 R/hour	6 minutes	30 minutes	1 hour	2.5 hours	10 hours
100 R/hour	36 seconds	3 minutes	6 minutes	15 minutes	1 hour