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
- Victims needing rescue
- Type of vehicle and containers 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:

- Packages with Yellow-III labels
- Exclusive Use LSA/SCO shipments
- Highway Route Controlled Quantity Shipments

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

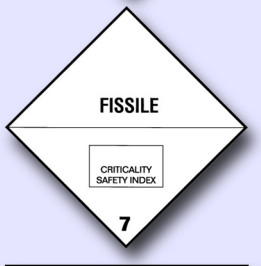
No Transport Index associated with this label

Radioactive Yellow-II
Expect > 0.5 mrem/hr up to 50 mrem/hr at surface of package

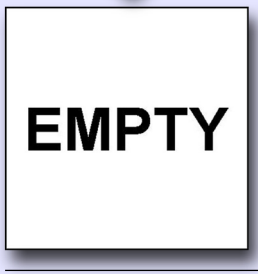
Maximum Transport Index is 1 or 1 mrem/hr at 1 meter

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. Package may still contain internal contamination

* 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 contact telephone number
- Proper Shipping Name and UN ID
- Name of radionuclides (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 III labels)
- The letters "RQ" if material is a Reportable Quantity of hazardous material
- Package Type (e.g., Type A, Type B, etc.)
- 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 very small amount of activity. To account for this, 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 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 mR/hour or R/hour.

Contamination occurs externally when loose particles of radioactive material are deposited on surfaces, skin, or clothing. Internal contamination occurs when radioactive particles are 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 counts per minute (CPM) or kilo counts per minute (kCPM).

Decontamination involves removing radioactive contamination from personnel or equipment. 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 treatment. Attempt to contain contamination on patient using a blanket or sheet and notify the hospital as soon as possible.

For non life-threatening injuries where you suspect patient contamination:

- Carefully cut away and remove patient's outer clothing
- Treat injuries as necessary
- Package patient on backboard using double blanket method
- Notify hospital 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 U.S. Department of Energy Transportation Emergency Preparedness Program and the Health Physics Society

www.em.doe.gov/otem www.hps.org

EPA Guidelines for Control of Emergency Exposures

Source: EPA 400-R-92-001

Dose Limit	Activity Performed	Condition
5 rem	All	
10 rem	Protection of major property	Where lower dose limit not practicable
25 rem	Lifesaving or protection of large populations	Where lower dose limit not practicable
> 25 rem	Lifesaving or protection of large populations	Only on a voluntary basis to personnel fully aware of the risks involved

Becquerel (Bq): A measure of the quantity of radioactivity. One becquerel is equal to 1 nuclear disintegration per second. See chart on other side for common prefixes used with the becquerel.
Fissile Material: Except for natural/depleted uranium, any material containing U-233, U-235, Pu-239 or Pu-241. Packages of fissile material 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 even if released in an accident. Examples would include uranium and thorium ores. Surface Contaminated Object (SCO) means a solid object which is not itself radioactive but which has radioactive material distributed on its surface. Examples would include contaminated tools and equipment.
Millirem (mrem): A unit of radiation dose equivalent to one-thousandth of a rem (which stands for roentgen equivalent man). It measures the amount of damage to human tissue from a dose of ionizing radiation. The average annual exposure for the general population is about 360 mrem.
Special Form: Radioactive material in an accident-tested, non-dispersible form.
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 (impact, fire, water immersion) 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 Type B package design. Unilateral means the package design is approved by the country of origin. Multilateral means the package design is approved by each country through or into which the package is to be transported.

Stay Time Table

Gamma Dose Rate	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