



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CONSEJO DE
SEGURIDAD NUCLEAR

PACIENTE IRRADIADO

- IRRADIACION
- SINDROME GENERAL DE IRRADIACION
- LESIONES ESTOCASTICAS



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS

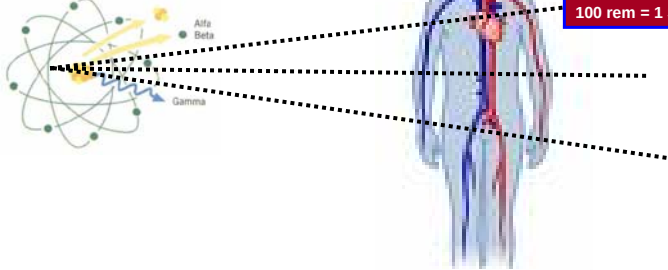


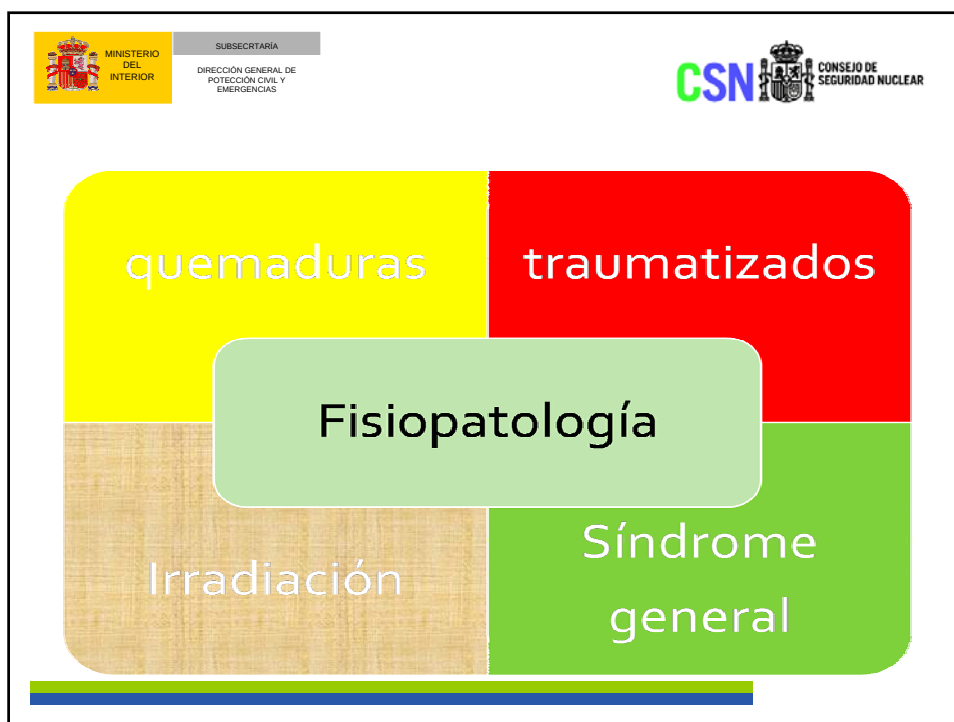
CONSEJO DE
SEGURIDAD NUCLEAR

ACTIVIDAD RADIACTIVA:
Cantidad de radiactividad que contiene una fuente o materia radiactiva
Se mide en: Curie o Becquerel

RADIACION ABSORBIDA:
Cantidad de radiación absorbida
Se mide en RAD o Gray
100 rad = 1 Gy

RADIACION EQUIVALENTE:
No toda la radiación absorbida por un cuerpo produce el mismo efecto sobre los órganos
= RA x FACTOR DE CALIDAD
Se mide en REM o Sievert
100 rem = 1 Sv









MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



ACTITUD INICIAL

- VALORACION SINTOMATICA ¿Qué nota o siente?
- DOSIMETRIA BIOLOGICA: MONITORIZACION ¿Cómo afecta a su cuerpo?
- DOSIMETRIA RADIOLOGICA: CORRELACION RADIACION EMITIDA-ABSORBIDA ¿hay relacion de causalidad?
- COINCIDENCIA LUGAR-DOSIS-SINTOMATOLOGIA.



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



ACTITUD INICIAL

- VALORACION SINTOMATICA ¿Qué nota o siente?
- DOSIMETRIA BIOLOGICA: MONITORIZACION ¿Cómo afecta a su cuerpo?
- DOSIMETRIA RADIOLOGICA: CORRELACION RADIACION EMITIDA-ABSORBIDA ¿hay relacion de causalidad?
- COINCIDENCIA LUGAR-DOSIS-SINTOMATOLOGIA



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



SINTOMAS Y SIGNOS			
< 1 SIEVERT	1 - 6 SIEVERT	6 - 20 SIEVERT	> 20 SIEVERT
Asintomático	Síndrome Hematopoyetico	Síndrome Gastrointestinal (GI)	Síndrome neurológico y vascular
Sintomas moderados o ausentes	Anorexia, nausea, vómitos, fatiga: 1 -4 hs post exposición relacionado con dosis y tiempo.	Precoz nauseas, vómitos, diarrea, anorexia y fatiga	Inmediatamente vomitos en proyectil, diarrea explosiva sanguinolenta, cefalea, colapso, confusión, pérdida de conocimiento, agitación, sensación de ardor en la piel
Episodio nauseas, vómitos en primeras 48 hs en 1 - 10% casos	Periodo de latencia 2 días - 4 semanas	Periodo de latencia horas - 1 semana	Quizás intervalo lucido de horas
Depresión leucocitaria moderada a las 2 - 4 semanas	Depresión medula ósea: leucopenia - infecciones; descenso plaquetas - hemorragias y hematomas	Grave cuadro GI unido a depresión de medula ósea: fiebre, dolor abdominal, retortijones, diarrea líquida, hemorragia intestinal, alteraciones electrolíticas, deshidratación	Síntomas neurológicos y cardiovasculares predominantes: convulsiones, coma, hipotensión arterial y shock
Embarazadas y dosis efectiva > 100 milisievert riesgo fetal	3 - 4 sieverts perdida de cabello en 2 -3 semanas	DL 100 = 10 sievert sin tratamiento en 2 semanas	Muerte en 2-3 días
	DL 50/60 = 4-5 sievert sin tratamiento		



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Table 2-N: Relative Radiosensitivity of Various Organs

Organs	Relative radiosensitivity	Chief mechanism of parenchymal hypoplasia
The hematopoietic and the gastrointestinal systems	High*	Destruction of parenchymal cells, especially the vegetative or differentiating cells
Skin; cornea & lens of eyes; gastrointestinal organs; cavity, esophagus, stomach, rectum	Fairy high	Destruction of vegetative and differentiating cells of the stratified epithelium
Growing cartilage; the vasculature; growing bones	Medium	Destruction of proliferating chondroblasts or osteoblasts; damage to the endothelium; destruction of connective tissue cells & chondroblasts or osteoblasts
Mature cartilage or bone; lungs; kidneys; liver; pancreas; adrenal gland; pituitary gland	Fairly low	Hypoplasia secondary damage to the fine vasculature and connective tissue elements
Muscle; brain; spinal cord	Low	Hypoplasia secondary damage to the fine vasculature and connective tissue elements, with little contribution by the direct effects on parenchymal tissues

*Embryonic tissue is also highly radiosensitive

Reference: Table 5-IV from FM 8-9 (Part I).



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



ACTITUD INICIAL

- VALORACION SINTOMATICA ¿Qué nota o siente?
- DOSIMETRIA BIOLOGICA: MONITORIZACION ¿Cómo afecta a su cuerpo?
- DOSIMETRIA RADIOLOGICA: CORRELACION RADIACION EMITIDA-ABSORBIDA ¿hay relacion de causalidad?
- COINCIDENCIA LUGAR-DOSIS-SINTOMATOLOGIA



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS

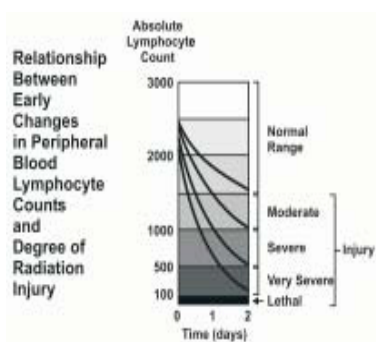
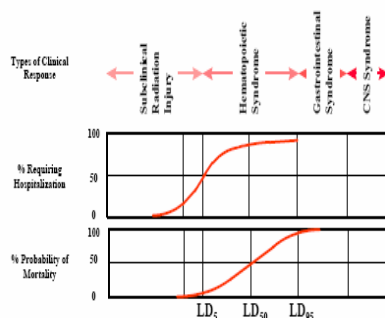


Figure 2-F: Clinical Effects of Whole Body Irradiation in Humans



Reference: Figure 6-V from FM 8-9 (Part I).



MINISTERIO
DEL
INTERIOR

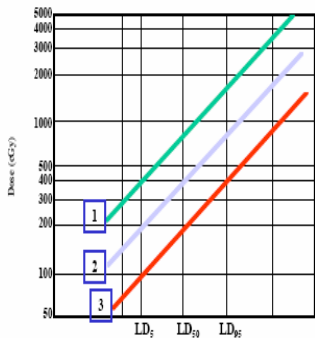
SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CONSEJO DE
SEGURIDAD NUCLEAR

Figure 2-G: Dose versus LD for Whole Body Irradiation



1- Dose response for low dose rate exposures (fallout).
2- Dose response for uncomplicated prompt exposure.
3- Dose response for prompt exposure complicated by combined injury.

Reference: Figure 6-V from FM 8-9 (Part I).

Table 5. Radiation dermatitis.

Radiation	Dose	Effect
Acute	6-20 Sv	Erythema only
	20-40 Sv	Skin breakdown in 2 wk
	> 3000 Sv	Immediate skin blistering
Chronic	> 20 Sv	Dermatitis, with cancer risk

Monitorización biológica

- Hematológica: Horas a días
 - Pancitopenia:
 - Depresión médula ósea
- Aparición enfermedades oportunistas En días
- Fracaso multiorgánico En días a semanas



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CSN CONSEJO DE
SEGURIDAD NUCLEAR

tratamiento

- Etiológico
- Sintomático
- paliativo
- Tratar isótopo
- Tratar síntomas
- Aminorar sufrimiento



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CSN CONSEJO DE
SEGURIDAD NUCLEAR

Tratamiento etiológico

- Irradiación
- Absorción
- Ingestión
- inhalación
- Uso de antídotos en función de isótopo
- Aislamiento
- Descontaminación
- Terapia sustitutiva/regenerativa
- Antibioterapia, antimicrobianos, antivirales



MINISTERIO DEL INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE PROTECCIÓN CIVIL Y EMERGENCIAS



Appendix B: Table of Internal Contaminant Radionuclides

Element	Respiratory absorption, deposition	GI absorption, deposition	Skin absorption, wound	Primary toxicity	Treatment
²⁴¹ Am	75% absorbed 10% retained	Minimal, usually insoluble	Rapid in first few days	Skeletal deposition Marrow suppression Hepatic deposition	Chelation with DTPA or EDTA
¹³⁷⁻¹³⁴ Cs	Completely absorbed Follows potassium	Completely absorbed Follows potassium	Completely absorbed Follows potassium	Renal excretion Beta and gamma emissions	Ion exchange resins Prussian blue
⁶⁰ Co	High absorption Limited retention	< 5% absorption	Unknown	Gamma emitter	Gastric lavage Penicillamine in severe cases
¹³¹ I	High absorption Limited retention	High absorption Limited retention	High absorption Limited retention	Thyroid ablation carcinoma	Iodine therapy
³² P	High absorption Limited retention	High absorption Limited retention	High absorption Limited retention	Bone, rapidly replicating cells	Lavage, Aluminum hydroxide Phosphates

• Tratamientos:

– EDTA

– AZUL PRUSIA

– PENICILAMINA

– IODURO POTASICO

– QUELANTES Y ANTI ADSORBENTES



MINISTERIO DEL INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE PROTECCIÓN CIVIL Y EMERGENCIAS



• TRATAMIENTOS:

– DTPA

– DIMERCAPROL

– SULFATO MAGNESICO

– CALCIO

– DIURESIS FORZADA

Appendix B: Table of Internal Contaminant Radionuclides

Element	Respiratory absorption, deposition	GI absorption, deposition	Skin absorption, wound	Primary toxicity	Treatment
²³⁸⁻²³⁹ metal or salt	High absorption Limited retention	Minimal, usually insoluble	Limited absorption May form nodules	Lung, bone, liver	Chelation with DTPA or EDTA
²³⁸⁻²³⁹ Pu	Limited absorption High retention	Minimal, usually insoluble	Limited absorption May form nodules	Local effects from retention in lung	Chelation with DTPA or EDTA Pulmonary lavage*
²¹⁰ Po	Moderate absorption Moderate retention	Minimal	Moderate absorption	Spleen, kidney	Lavage Dimercaprol
²²⁶ Ra	Unknown	30% absorption, but 95% fecal excretion	Unknown	Skeletal deposition Marrow suppression Sarcoma	MgSO ₄ lavage Ammonium chloride Calcium Alginate
⁹⁰ Sr	Limited retention	Moderate absorption	Unknown	Bone – follows calcium	Strontium Calcium Ammonium chloride
Tritium (T or ³ H) Hydrogen-3 Tritiated water = HTO	HT – minimal HTO – complete	HT – minimal HTO – complete	HTO – complete	Panmyelocytopenia	Dilution with controlled water intake, Diuresis

Element	Respiratory absorption, deposition	GI absorption, deposition	Skin absorption, wound	Primary toxicity	Treatment
²³⁸⁻²³⁵ U fluorides UO ₃ , sulfates, carbonates	High absorption	High absorption	High absorption Skin irritant	Renal, urinary excretion	Chelation with DTPA* or EDTA NaHCO ₃
²³⁸⁻²³⁵ U Some oxides, nitrates	Moderate absorption High retention	Moderate absorption	Unknown	Nephrotoxic Urinary excretion	Chelation with DTPA* or EDTA NaHCO ₃
²³⁸⁻²³⁵ U High oxides, hydrides, carbides, salvage ash	Minimal absorption Retention based on particle size	Minimal absorption High excretion	Unknown	Nephrotoxic Urinary excretion	Chelation with DTPA* or EDTA NaHCO ₃
²²⁸ U Depleted uranium metal	Retention based on particle size	Minimal absorption High excretion	Forms pseudocysts with urinary excretion Limited absorption	Nephrotoxic Deposits in bone, kidney, brain	Particulate removal when possible

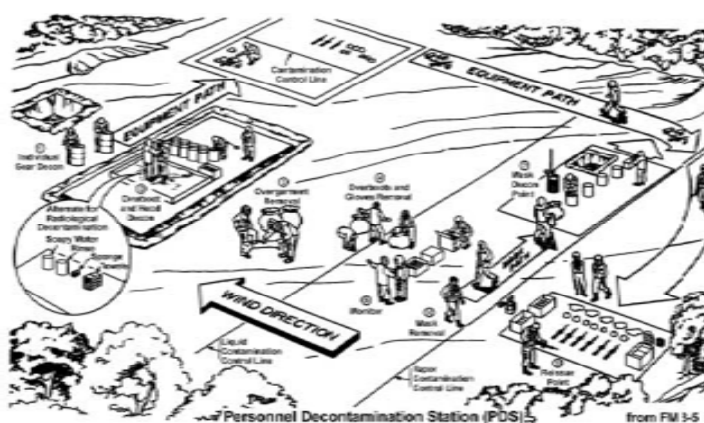
*Treatment is not approved by the Food and Drug Administration. Clinical investigations have not begun in the United States.

- TRATAMIENTOS

•

– BICARBONATO
SODICO

- EDTA





SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Table 2. Recommendations for use of cytokines for patients expected to experience severe neutropenia.

Filgrastim (G-CSF)	2.5–5 µg/kg/d QD s.c. (100–200 µg/m ² /d)
Sargramostim (GM-CSF)	5–10 µg/kg/d QD s.c. (200–400 µg/m ² /d)
Pegfilgrastim (pegG-CSF)	6 mg once s.c.



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Antídotos

- Quelantes
 - DTPA
 - AZUL DE PRUSIA
 - IODURO POTÁSICO:
 - 130 mg aprox.



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Table 2-O: Preliminary Triage of Casualties with Possible Radiation Injuries

Symptoms	Possible category of radiation injury		
	Unlikely	Probable	Severe
Nausea	Absent	Excessive	Very Excessive
Vomiting	Absent	Present	Very Excessive
Diarrhea	Absent	Absent to Present	Absent to Very Excessive
Hyperthermia	Absent	Absent to Present	Present to Very Excessive
Hypothermia	Absent	Absent	Present to Very Excessive
Erythema	Absent	Absent	Absent to Excessive
CNS dysfunction	Absent	Absent	Absent to Excessive

Reference: Table 6-II from FM 8-9 (Part I).

TABLE 2-O: PRELIMINARY TRIAGE OF CASUALTIES WITH POSSIBLE RADIATION INJURIES



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Table 2-P: Radiation Doses and Combined Injuries

Starting Triage Classifications	Final Triage Classifications		
	Less than 150 cGy	150-550 cGy	Over 550 cGy
Radiation Only	Minimal or duty	Delayed**	Delayed
Immediate	Immediate	Immediate or Expectant*	Expectant
Delayed	Delayed	Delayed or Expectant*	Expectant
Minimal	Minimal	Minimal**	Expectant
Expectant	Expectant	Expectant	Expectant

*Select Expectant in the case of full or partial thickness burns coverings more than 18 % of the body surface, or trauma which would either result in significant infection or be categorized as severe but not immediately life threatening, such as a fractured femur. This is a clinical decision and not necessarily subjectively reproducible.

**Includes the probable requirements for antibiotics and transfusion at a later time. So this classification does not suggest that the patient is not in need of treatment, but rather that he does not need immediate specialized care.

Reference: Table 4-2 from FM 8-10-7 and comments from AFRR1.

TABLE 2-P: RADIATION DOSES AND COMBINED INJURIES



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS

CSN



CONSEJO DE
SEGURIDAD NUCLEAR

Table 2-Q (Part 1): Medical Response to Nuclear Radiation

Dose range (cGy free in air)	Onset and duration of initial symptoms
0 to 70	From 6 to 12 hours: none to slight incidence of transient headache and nausea; vomiting in up to 5 percent of personnel in upper part of dose range.
70 to 150	From 2 to 20 hours: transient mild nausea and vomiting in 5 to 30 percent of personnel.
150 to 300	From 2 hours to 3 days: transient to moderate nausea and vomiting in 20 to 70 percent; mild to moderate fatigability and weakness in 25 to 60 percent of personnel.
300 to 530	From 2 hours to 3 days: transient nausea and vomiting in 50 to 90 percent; moderate fatigability in 50 to 90 percent of personnel.
530 to 830	From 2 hours to 2 days: moderate to severe nausea and vomiting in 80 to 100 percent of personnel. From 2 hours to 6 weeks: moderate to severe fatigability and weakness in 90 to 100 percent of personnel.
830 to 3000	From 30 minutes to 2 days: severe nausea, vomiting, fatigability, weakness, dizziness, and disorientation; moderate to severe fluid imbalance and headache.
3000 to 8000	From 30 minutes to 5 days: severe nausea, vomiting, fatigability, weakness, dizziness, disorientation, fluid imbalance, and headache.
Greater than 8000	From 30 minutes to 1 day: severe and prolonged nausea, vomiting, fatigability, weakness, dizziness, disorientation, fluid imbalance, and headache.

Reference: Table 7-I from FM 8-9, Table 4-1 from FM 8-10-7, Table 4-10 from FM 3-7.



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

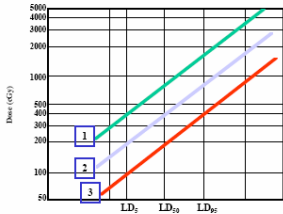
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS

CSN



CONSEJO DE
SEGURIDAD NUCLEAR

Figure 2-G: Dose versus LD for Whole Body Irradiation



1- Dose response for low dose rate exposure (solid).
2- Dose response for uncomplicated prompt exposure.
3- Dose response for prompt exposure complicated by combined injury.

Reference: Figure 6-V from FM 8-9 (Part I).

Table 3-A: Background Radiation Levels (external)

Location	Levels (cGy/yr)
New York City	0.091
Denver	0.172
Guarapari, Brazil	0.640

Reference: ACALA's Radioactive Material Handling Safety



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CONSEJO DE
SEGURIDAD NUCLEAR



Table 3-B: Radiation exposure pathways from nuclear plants

Radiionucleide	Effluent	Exposure Pathway	Critical Organ
Iodine	Airborne	General deposition (external)	Whole body
		For inhalation	Thyroid
		Grass → cow → milk	Thyroid
	Liquid	Leafy vegetables	Thyroid
		Drinking water	Thyroid
		Food (and shellfish consumption)	Thyroid
Tritium	Airborne	For inhalation (external)	Skin
	Liquid	Drinking water	Whole body
		Food consumption	Whole body
		Drinking water	Whole body
Cesium	Airborne	Food consumption	Whole body
		General deposition (external)	Whole body
		Grass → cow → milk or meat	Whole body
	Liquid	Inhalation	Whole body
		Sediment (external)	Whole body
		Drinking water	Whole body
Metals (iron, cobalt, nickel, zinc, copper)	Liquid	Food consumption	Whole body
		Drinking water	Whole body
		Food consumption	Whole body
	Direct radiation from plant	External	Whole body

Table 3-C: Industrial Sources of Radiation

Locations and Materials	Radiation Sources	Source Strength	Comments
Gauges, Sources, Static Eliminators	Iridium-192, Cesium-137, Cobalt-60, Radium-226, neutrons, Americium-241, Polonium-210	Greater than about 4 TBq	Sealed sources, and if leaking, surface contamination.
X-ray Machine Sterilizers, Processors, and Particle Accelerators	X-rays, protons, deuterons, electrons, gammas, Cesium-137, Cobalt-60	~4 TBq to ~40PBq	Anywhere in an industrial area. Be aware of possible activation products.
Mineral Extraction and Processing – including phosphate fertilizers, oil, natural gas, and coal.	Naturally Occurring Radioactive Materials – Uranium, Thorium, and progeny	Generally low level with external exposures from background to about 0.01mSv (1 mrem)	Dispersed low level material and scale buildup in piping. Also, gauges as noted above. It is possible for radon to be of concern.
Power Sources	Plutonium-238, Strontium-90	Plutonium-238: up to 4 GBq Strontium-90: up to 1 TBq	In equipment in isolated areas.
Radioluminescent Materials	Promethium-147, Tritium, Radium-226	Up to tens of TBq	Various areas, and if leaking, surface contamination.

Reference: Shleien 83, Shleien 92.



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CONSEJO DE
SEGURIDAD NUCLEAR

Table 3-C: Industrial Sources of Radiation

Locations and Materials	Radiation Sources	Source Strength	Comments
Gauges, Sources, Static Eliminators	Iridium-192, Cesium-137, Cobalt-60, Radium-226, neutrons, Americium-241, Polonium-210	Greater than about 4 TBq	Sealed sources, and if leaking, surface contamination.
X-ray Machine Sterilizers, Processors, and Particle Accelerators	X-rays, protons, deuterons, electrons, gammas, Cesium-137, Cobalt-60	~4 TBq to ~40PBq	Anywhere in an industrial area. Be aware of possible activation products.
Mineral Extraction and Processing – including phosphate fertilizers, oil, natural gas, and coal.	Naturally Occurring Radioactive Materials – Uranium, Thorium, and progeny	Generally low level with external exposures from background to about 0.01mSv (1 mrem)	Dispersed low level material and scale buildup in piping. Also, gauges as noted above. It is possible for radon to be of concern.
Power Sources	Plutonium-238, Strontium-90	Plutonium-238: up to 4 GBq Strontium-90: up to 1 TBq	In equipment in isolated areas.
Radioluminescent Materials	Promethium-147, Tritium, Radium-226	Up to tens of TBq	Various areas, and if leaking, surface contamination.

Reference: Shleien 83, Shleien 92.

MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS

CSN

CONSEJO DE
SEGURIDAD NUCLEAR

Table 3-D: Medical and Research Sources of Radiation

Locations and Materials	Radiation Sources	Source Strength	Comments
Cancer Treatment Areas	Cobalt-60 and Cesium-137	~1 to several 10 Gy over several hours at about one meter if the source is exposed.	Found in therapy rooms.
Sources and Applicators	Cesium-137, Iridium-192, Radium-226, Phosphorous-32, Strontium-90, Iodine-125	Tens of MBq	Therapy and nuclear medicine areas.
Radiopharmaceuticals	Iodine-131, Iodine-123, Technetium-99 ^m , Thallium-201, Xenon-133	Tens of MBq	Storage, nuclear medicine areas and transportation.
X-ray Machines and Accelerators	X-rays and Electrons	~0.01 Gy min ⁻¹ at the source	Radiology or therapy rooms.
Various Sources and Devices	Tritium, Carbon-14, Sodium-22, Sodium-24, Sulfur-35, Calcium-45, Cobalt-60	Up to tens of TBq	Various areas, and if leaking, surface contamination.
Particle Accelerators	X-rays, alphas, protons, deuterons, electrons, gammas	~4 TBq to ~40PBq	Anywhere in an industrial area. Be aware of possible activation products.
Experimental Reactors and Critical Assemblies	Fission products, neutrons, fissile and fissionable material, transuranics	Up to tens of TBq	Various areas, up to square kilometers in the case of widespread contamination.

Reference: Shleien 83, Shleien 92.



MINISTERIO
DEL
INTERIOR

SUBSECRETARÍA

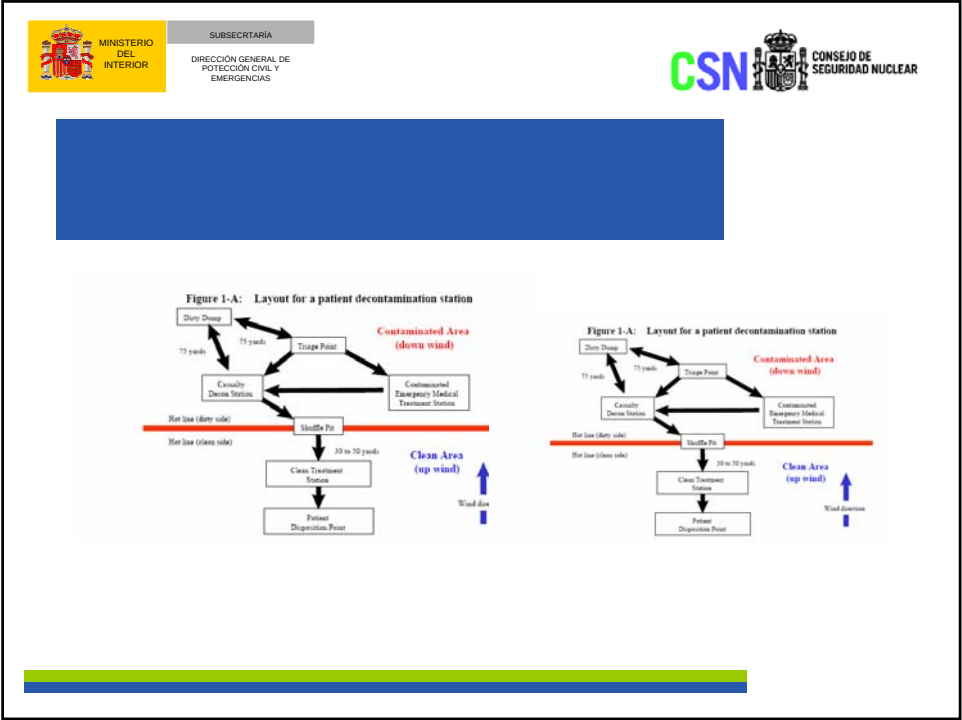
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



CONSEJO DE
SEGURIDAD NUCLEAR

Table 3-P: Spectrum of Radiation Limits (CentiGray)

Dose	Function	Dose	Function
500	LD 50/60 with supportive care	10	Protection valuable prop; EPA
350	LD 50/60 without supportive care	5.0	Occupational annual limit; 10 CFR
300	Early erythema	5.0	Public organ dose limit; 10 CFR
200	Threshold for cataract	0.5	Average all X-ray procedures; NCRP
150	Emergency risk; STANAG 2083	0.5	Public, annual, infrequent; NCRP
100	Urgent action, accident; ICRP 63	0.30	Naturally occurring annual dose, US; NCRP
70	Moderate risk; STANAG 2083	0.10	Public, annual, continuous exposure; NCRP
50	Negligible risk; STANAG 2083	0.10	Public; 10 CFR
50	Emergency limit; ICRP	0.015	Annual Public limit for decontamination; EPA
25	Life saving; EPA	0.001	Insignificant dose; NCRP





MINISTERIO DEL INTERIOR

SUBSECRETARÍA

DIRECCIÓN GENERAL DE PROTECCIÓN CIVIL Y EMERGENCIAS



CONSEJO DE SEGURIDAD NUCLEAR

Monitorización biológica /hematológica



Table 1. Biological dosimetry assays and operational parameters.

Class of biomarker	Assay	Time window	Operating dose window (Gy, acute photon-equivalent)
Prodromal signs and symptoms	Onset of vomiting	< 12 hours	2–20
Hematological	Depletion of peripheral blood lymphocytes	< 1.5 weeks	2–8
Cytological	Lymphocyte-metaphase spread dicentric	< several months*	0.2–5
	Lymphocyte-premature chromosome condensation	< several months*	0.2–20

*Generally, blood is sampled 24 hours after radiation exposure for cytological chromosome aberration analysis of dose.

Table F2. Symptom clusters as delayed effects after radiation exposure.	Gastrointestinal	Anorexia	Partial and full thickness skin damage	Lymphopenia
	Fatigue	Nausea	Epilation (hair loss)	Neutropenia
	Weakness	Vomiting	Ulceration	Thrombocytopenia
		Diarrhea		Pyrexia
				Opportunistic infections

Aislamiento y soporte general avanzado



Tratamiento sintomático

- Dolor
- Fiebre
- Náuseas y vómitos
- Recursos medicina paliativa
- Escalera analgésica
 - Analgésicos AINES, mórficos y coadyuvantes
- Antipiréticos
- antieméticos



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Tratamiento paliativo

- Sedación
- Analgesia
- Comfort
- Morficos
- Hipnoticos
- Sedantes
- hidratacion



SUBSECRETARÍA
DIRECCIÓN GENERAL DE
PROTECCIÓN CIVIL Y
EMERGENCIAS



Fin de la segunda parte

