TABLES

Area and Resource Surveys
Table 1. Contamination Instrument Readings

Communications
Table 1. MERS and MATTS Regional Responsibilities
Table 2. Additional FEMA Assets

Contamination Control
Table 1. CCS Materials List
Table 2. CCS Personnel

Conversion Factors for Weapons Grade Plutonium
Table 1. Conversion Factors for Weapons Grade Plutonium
Table 2. Approximate Factors for Converting Alpha Readings for Various Surface Types
Table 3. Conversion Table (CPM to µg/m2 or µCi/m2) AN/PDR-56 Alpha Meter
Table 4. Conversion Table (CPM to µg/m2 or µCi/m2) ADM-300
Table 5. Conversion Table (Megabequerel (MBq) to Millicuries (mCi) and Microcuries µCi)
Table 6. Conversion to International System Units

Environmental Sampling
Table 1. Air Sampler Calibration
Table 2. Air Sampler placement (No. 2) Distance

Health and Safety
Table 1. Radiological Characteristics of Plutonium and Americium
Table 2. Radiological Characteristics of Uranium
Table 3. Radiological Characteristics of Tritium
Table 4. Radiological Characteristics of Thorium
Table 5. Recommended Respiratory Protection Levels for Emergency Workers as a Function of Airborne contamination
Table 6. Protective Devices for Emergency Workers as a Function of Surface Contamination
Table 7. Instrument Comparisons for Surface Contamination Levels in Table 6
Table 8. Protective Action Guide Hazard Values
Table 9. Equation for Calculating Resuspension Factors
Table 10. Work-Rest Cycles and Fluid Replacement Guidelines

Incident Command System Functional Appendix
Table 1. ICS and DoD Staff Equivalency
Table 2. Sample Basic Operational Period IAP
TAB A. JFO Incident Action Plan

Inter-DoD Functional Annex
Table 1. Organizations with Cooperating Agency Responsibilities

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Medical
Table 1. Guidelines for Bioassay Sampling
Table 2. Guidelines for Assigning Priorities for Collecting and Processing Bioassays
Table 3. Sample Instrument Readings to Determine Bioassay Priority in Table 2

Radiation Detection and Measurement
Table 1. Commonly Considered Radioactive Contaminants and Their Primary Associated Radioactive Emissions

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Radiological Monitoring Equipment
Table 1. Alpha Survey Instruments
Table 2. Beta and Gamma Survey Instruments
Table 3. Instrument Sets
Table 4. Tritium Survey Instruments
Table 5. Dosimeters

AREA AND RESOURCE SURVEYS

Table 1. Contamination Instrument Readings

Instrument	Probe (area in square cm)	Activity (microcurie/ square meter)	Instrument Indication†
AN-PDR-56	*DT224B (17)	0.5	~850 cpm
ADM-300	#ASP 100 (100)	0.5	~2,200 cpm
E-600	‡SHP 380 (100)	0.5	~5,500 cpm

† Above background
*assumed α efficiency (4π) for DT224B is 45%
#assumed α efficiency (4π) for ASP 100 is 20%
‡assumed α efficiency (4π) for SHP380 is 50%

If instrument efficiencies are different than those assumed, instrument indications will need to be corrected.

COMMUNCIATIONS

Table 1. MERS and MATTS Regional Responsibilities

MERS or MATTS	Area of Responsibility
Maynard, MA MERS Detachment	FEMA Regions I and II
Thomasville, GA MERS Detachment	FEMA Regions III and IV
Denton, TX MERS Detachment	FEMA Regions VI and VII
Bothell, WA MERS Detachment	FEMA Regions IX and X
Denver, CO MERS	FEMA Regions V and VIII
Berryville, VA MATTS	As required

See also:

Figure 1. FEMA Regions

COMMUNCIATIONS

Table 2. Additional FEMA Assets

Type	Purpose
Fiber optic cable	Inter-site communication distribution
Private Branch Exchanges (MERLIN and G3) and telephones	Telephones and switches capable of supporting 25-300 people
Multiplexers (IDNX and IMUX), D4 channel banks, routers, and file servers	Communications routing and exchange
Personal computers with standard software configured in local and wide area networks	For use by the Federal responders
VHF and UHF radios	For local radio networks. These can be extended with repeaters
Video broadcast	To record and disseminate video information from the disaster location
INMARSAT and AMSC satellite telephones	Provide single channel voice or data

CONTAMINATION CONTROL

Table 1. CCS Materials List

Equipment	Quantity
Alpha particle monitoring equipment	4
Lighting for night operations	as needed
Low-level beta and/or gamma monitoring instrument	4
Dosimeters	as needed
2-inch or wider masking tape	3 rolls
NBC marking kit or substitute	1
Stools or chairs	4
55-gallon drums or equivalent for storing contaminated items	4
Plastic bags; sized to fit the barrels and/or drums used	20
Brushes	4
Whisk brooms	4
Shovels	4
Traffic cones, ropes, and stakes	as needed
Protective masks (SCBA, if available)	as needed
Personal Protective suits	as needed
Cotton gloves	as needed
Booties or foot covers	as needed
Water container; 5 gallons or larger	1
Paper towels or substitute	as required
Liquid soap; 1 gallon or more	1
Tables	5
Craft paper, butcher paper, or substitute	1 roll
Rain suits, ponchos, or substitute	as needed
Surgical masks	1 box
Organic solvents; 1 gallon or more	1
Large tent (20 or 40 men) or trailer with popup sun covers	as needed
Portable generator (as needed)	1
Portable heaters, air-conditioners, fans	as needed
Blankets	as needed
Litters	4
Non-slip plastic sheeting	1 roll
Bar Soap (Dozen) and/or Shampoo	as needed
Towels	as needed
Cotton Swabs	as needed
Bioassay Containers	as needed
Hair Brushes	as needed

CONTAMINATION CONTROL

Table 2. CCS Personnel

Position	Function
One medical doctor	Monitor general health and treat personnel injuries.
One health physicist/bioenvironmental engineer	Monitor personnel, area, and facilities for contamination; estimates exposure and assesses effectiveness of decontamination and other contamination control measures.
One CCS supervisor	Monitor supply levels and control flow through the CCS.
One security guard	Monitor for unauthorized or unprocessed access and/or egress.
Eight assistants	Accomplish activities as directed by the CCS supervisor.
One RADIAC repair person	Repair any RADIAC equipment from the CCS.
One TLD and/or dosimeter monitor	Issue dosimetry, log out and log in personnel that go to and from site.

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Table 1. Conversion Factors for Weapons Grade Plutonium

To Convert	Into	Multiply by	To Convert	Into	Multiply by
µCi/m^2	µg/m^2	13	µCi/g	µCi/m^2	1.5×10^4
µCi/m^2	dpm/m^2	2.2×10^{-6}	µCi/g	µg/m^2	2×10^5
µCi/m^2	dpm/cm^2	220	µCi/g	dpm/m^2	3.3×10^{10}
µCi/m^2	dpm/g	150	µCi/g	dpm/cm^2	3.3×10^6
µCi/m^2	µCi/g	6.7×10^{-5}	µCi/g	dpm/g	2.2×10^6
µCi/m^2	pCi/g	67	µCi/g	pCi/g	10^6
µg/m^2	µCi/m^2	0.075			
µg/m^2	dpm/m^2	1.7×10^5	pCi/g	µCi/m^2	1.5×10^{-2}
µg/m^2	dpm/cm^2	17	pCi/g	µg/m^2	0.20
µg/m^2	dpm/g	11	pCi/g	dpm/m^2	3.3×10^4
µg/m^2	µCi/g	5×10^{-6}	pCi/g	dpm/cm^2	3.3
µg/m^2	pCi/g	5	pCi/g	dpm/g	2.2
dpm/m^2	µCi/m^2	4.5×10^{-7}	pCi/g	µCi/g	10^{-6}
dpm/m^2	µg/m^2	6.1×10^{-6}	µ units	units	10^{-6}
dpm/m^2	dpm/cm^2	10^{-4}	units	µ units	10^6
dpm/m^2	dpm/g	6.7×10^{-5}			
dpm/m^2	µCi/g	3.0×10^{-11}			
dpm/m^2	µCi/g	3.0×10^{-5}			
dpm/cm^2	µCi/m^2	4.5×10^{-3}			
dpm/cm^2	µg/m	6.1×10^{-2}			
dpm/cm^2	dpm/m^2	10^4			
dpm/cm^2	dpm/g	0.67			
dpm/cm^2	µCi/g	3.0×10^{-7}			
dpm/cm^2	pCi/g	0.3			
dpm/g	µCi/m^2	6.8×10^3			
dpm/g	µg/m^2	0.091			
dpm/g	dpm/m^2	1.5×10^4			
dpm/g	dpm/cm^2	1.5			
dpm/g	µCi/g	4.5×10^{-7}			
dpm/g	pCi/g	0.45			

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Table 2. Approximate Factors for Converting Alpha Readings for Various Surface Types

Type of Surface	Correction Factor
Soil	.006
Concrete	.005
Plywood	.004
Stainless Steel	.0025

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Table 3. Conversion Table (CPM to µg/m^2 or µCi/m^2) AN/PDR-56 Alpha Meter

CPM	SOIL		CONCRETE		PLYWOOD		STAINLESS STEEL	
AN/ PDR-56	µg/m^2 Pu-239	µCi/m^2 Pu-239	µg/m^2 Pu-239	µCi/m^2 Pu-239	µg/m^2 Pu-239	µCi/m^2 Pu-239	µg/m^2 Pu-239	µCi/m^2 Pu-239
50	1.2	.09	1.0	.075	.8	.06	.5	.038
100	2.4	.18	2.0	.15	1.6	.12	1.0	.075
200	4.8	.36	4.0	.30	3.2	.24	2.0	.15
400	9.6	.72	8.0	.60	6.4	.48	4.0	.30
600	14.4	1.08	12.0	.90	9.6	.72	6.0	.45
800	19.2	1.44	16.0	1.20	12.8	.96	8.0	.60
1,000	24.0	1.80	20.0	1.50	16.0	1.20	10.0	.75
1,200	28.8	2.16	24.0	1.80	19.2	1.44	12.0	.90
1,500	36.0	2.70	30.0	2.25	24.0	1.80	15.0	1.13
2,000	43.2	3.24	36.0	2.70	28.8	2.16	18.0	1.35
2,200	52.8	3.96	44.0	3.30	35.2	2.64	22.0	1.65
2,500	60.0	4.50	50.0	3.75	40.0	3.00	25.0	1.88
2,800	67.2	5.04	56.0	4.20	44.8	3.36	28.0	2.10
3,000	72.0	5.40	60.0	4.50	48.0	3.60	30.0	2.25
4,000	96.0	7.20	80.0	6.00	64.0	4.80	40.0	3.00
5,000	120.0	9.00	100.0	7.50	80.0	6.00	50.0	3.75
8,000	192.0	14.40	160.0	12.00	128.0	9.60	80.00	6.00
10,000	240.0	18.00	200.0	15.00	160.0	12.00	100.0	7.50
11,000	264.0	19.80	220.0	16.50	176.0	13.20	110.0	8.25
12,000	288.0	21.60	240.0	18.00	192.0	14.40	120.0	9.00
25,000	600.0	45.00	500.0	37.50	400.0	30.00	250.0	18.75
50,000	1,200.0	90.00	1,000.0	75.00	800.0	60.00	500.0	37.50
75,000	1,800.0	135.00	1,500.0	112.50	1,200.0	90.00	750.0	56.25
100,000	2,400.0	180.00	2,000.0	150.00	1,600.0	120.00	1,000.0	75.00
150,000	3,600.0	270.00	3,000.0	225.00	2,400.0	180.00	1,500.0	112.50
200,000	4,800.0	360.00	4,000.0	300.00	3,200.0	240.00	2,000.0	150.00
300,000	7,200.0	540.00	6,000.0	450.00	4,800.0	360.00	3,000.0	225.00

*To convert µCi/m^2 to Bq/m^2, multiply by 3.7 x 10^4.

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Table 4. Conversion Table (CPM to μg/m^2 or μCi/m^2) ADM-300

CPM	Soil		Concrete		Plywood		Stainless Steel	
ADM - 300	μg/m^2	μCi/m^2	μg/m^2	μCi/m^2	μg/m^2	μCi/m^2	μg/m^2	μCi/m^2
	Pu-239	Pu-239	Pu-239	Pu-239	Pu-239	Pu-239	Pu-239	Pu-239
50	0.19	0.01	0.16	0.01	0.13	0.01	0.08	0.006
100	0.39	0.03	0.33	0.02	0.26	0.02	0.16	0.012
200	0.78	0.06	0.66	0.05	0.52	0.04	0.32	0.024
400	1.56	0.12	1.32	0.10	1.04	0.08	0.64	0.048
600	2.34	0.18	1.98	0.15	1.56	0.12	0.96	0.072
800	3.12	0.23	2.64	0.20	2.08	0.16	1.28	0.096
1,000	3.90	0.29	3.30	0.25	2.60	0.19	1.60	0.12
1,200	4.68	0.35	3.96	0.30	3.12	0.23	1.92	0.14
1,500	5.85	0.44	4.95	0.37	3.90	0.29	2.40	0.18
1,800	7.02	0.53	5.94	0.45	4.68	0.35	2.88	0.22
2,200	8.58	0.64	7.26	0.55	5.72	0.43	3.52	0.26
2,500	9.75	0.73	8.25	0.62	6.50	0.49	4.00	0.30
2,800	10.9	0.82	9.24	0.69	7.28	0.55	4.48	0.34
3,000	11.7	0.88	9.90	0.74	7.80	0.58	4.80	0.36
4,000	15.6	1.17	13.2	0.99	10.4	0.78	6.40	0.48
5,000	19.5	1.46	16.5	1.24	13.0	0.97	8.00	0.60
8,000	31.2	2.34	26.4	1.98	20.8	1.56	12.8	0.96
10,000	39.0	2.93	33.0	2.47	26.0	1.95	16.0	1.20
12,000	46.8	3.51	39.6	2.97	31.2	2.34	19.2	1.44
20,000	78.0	5.85	66.0	4.95	52.0	3.90	32.0	2.40
25,000	97.5	7.31	82.5	6.19	65.0	4.87	40.0	3.00
50,000	195.0	14.62	165.0	12.37	130.0	9.75	80.0	6.00
75,000	292.5	21.94	247.5	18.56	195.0	14.62	120.0	9.00
100,000	390.0	29.25	330.0	24.75	260.0	19.50	160.0	12.0
150,000	585.0	43.87	495.0	37.12	390.0	29.25	240.0	18.0
200,000	780.0	58.50	660.0	49.50	520.0	39.00	320.0	24.0
300,000	1170.0	87.75	990.0	74.25	780.0	58.50	480.0	36.0

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Table 5. Conversion Table (Megabequerel (MBq) to Millicuries (mCi) and Microcuries µCi)

MBq	mCi	MBq	µCi
7,000	189.	30	810
6,000	162.	20	540
5,000	135.	10	270
4,000	108.	9	240
3,000	81.	8	220
2,000	54.	7	189
1,000	27.	6	162
900	24.	5	135
800	21.6	4	108
700	18.9	3	81
600	16.2	2	54
500	13.5	1	27
400	10.8	0.9	24
300	8.1	0.8	21.6
200	5.4	0.7	18.9
100	2.7	0.6	16.2
90	2.4	0.5	13.5
80	2.16	0.4	10.8
70	1.89	0.3	8.1
60	1.62	0.2	5.4
50	1.35	0.1	2.7
40	1.08		

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Table 6. Conversion to International System Units

1 Ci = 3.7×10^{10} Bq	1 rad = 10^{-2} Gy
1 Bq = 2.7×10^{-11} Ci	1 Gy = 100 rad
1 rem = 10^{-2} Sv	
1 Sv = 100 rem	

SI Units:
Becquerel (Bq)
Sievert (Sv)
Gray (Gy)

ENVIRONMENTAL SAMPLING

Table 1. Air Sampler Calibration

Filter Type	Calibration Kit	Flow Rate	Operation Time
4" TFA #41	CKHV	18 CFM	55 min
4" TFA #2133	CKHV	36 CFM	28 min
4" TFA “S”	CKHV	70 CFM	15 min
8" x 10" TFA-810	CKHV-810	50 CFM	20 min

ENVIRONMENTAL SAMPLING

Table 2. Air Sampler Placement (No. 2) Distance

Wind Speed		Approximate Downwind Distance	
Miles Per Hour (MPH)	**(Knots)**	**(Meters)**	**(Feet)**
6 to 10	4 to 9	1,000	3,300
11 to 15	10 to 13	1,500	5,100
16 to 20	14 to 17	2,000	6,600
Above 20	Above 17	2,500	8,200

HEALTH AND SAFETY

Table 1. Radiological Characteristics of Plutonium and Americium

Isotope	Primary Particle Emitted	Half-Life* in Years
Pu-239	alpha	24,100
Pu-240	alpha	6570
Pu-241	beta	14.4
Pu-242	alpha	376,000
Am-241	alpha	432

*See Definition List

HEALTH AND SAFETY

Table 2. Radiological Characteristics of Uranium

Isotope	Primary Particle Emitted	Half-Life in Years
U-238	alpha	4,500,000,000
U-235	alpha	710,000,000
U-234	alpha	2,150,000

HEALTH AND SAFETY

Table 3. Radiological Characteristics of Tritium

Isotope	Primary Particle Emitted	Half-Life in Years
H-3	beta	12.26

HEALTH AND SAFETY

Table 4. Radiological Characteristics of Thorium

Isotope	Primary Particle Emitted	Half-Life in Years
Th-223	alpha	14,100,000,000

HEALTH AND SAFETY

Table 5. Recommended Respiratory Protection Levels for Emergency Workers as a Function of Airborne Contamination

Airborne Alpha Activity dpm/m^3 above background	**Respiratory Protection**
Below 13.32 dpm/m^3	No respiratory protection needed.
13.32 to 665 dpm/m^3	Full-face respiratory protection required (M-series Protective Mask or National Institute of Occupational Safety and Health/ Mine Safety and Health Administration approved High Efficiency Particulate Air (HEPA) respirator).
Above 665 dpm/m^3	Pressure demand SCBA or limited entry restricted to essential personnel wearing full-face respiratory protection. Source of contamination should be fixed as soon as possible.

HEALTH AND SAFETY

Table 6. Protective Devices for Emergency Workers as a Function of Surface Contamination

Surface Contamination			Respiratory Protection
Activity µCi/m2	**dpm per 100 cm^2**	**cpm (ADM-300)**	
< 6	< 133,200	< 20,000	No respiratory protection. If there is detectable contamination, gloves and booties should be worn at a minimum, and coveralls depending on the activity being performed.
6 to < 60	133,200 to 1,332,000	20,000 to 200,000	No respiratory protection for limited entries of up to 4 hours. Full protective clothing.
60 to 300	1,332,000 to 6,660,000	266,400 to 1,332,000	Air-purifying respirator (APR) and full protective clothing.
Above 300	Above 6,660,000	Above 1,332,000	Wear pressure-demand SCBA and full protective clothing. Source of contamination should be fixed as soon as possible.

Note: The above (revised) numbers are based on the corrected DAC of 13.32 dpm/m^3, the revised APF of 50, and an assumption of a 10^{-6} resuspension factor.

HEALTH AND SAFETY

Table 7. Instrument Comparisons for Surface Contamination Levels in Table 6.

Instrument	Probe (area, in cm^2)	Activity (µCi/m2)	Instrument indication
AN-PDR-56	*DT224B (17)	6.0	~10,200 cpm
ADM-300	#ASP 100 (100)	6.0	~26,500 cpm
E-600	‡SHP 380 (100)	6.0	~66,500 cpm
AN-PDR-56	*DT224B (17)	60	~100,000 cpm
ADM-300	#ASP 100 (100)	60	~250,000 cpm
E-600	‡SHP 380 (100)	60	~650,000 cpm
AN-PDR-56	*DT224B (17)	300	~500,000 cpm
ADM-300	#ASP (100)	300	~1,300,000 cpm
E-600	‡SHP 380 (100)	600	**Off Scale (>1.0E6 cpm)

**The instruments with 100/square cm scintillation probes are incapable of measuring deposited activities much greater than 60 microcuries/square meter, because the instrument goes off-scale high.

*assumed α efficiency (4π) for DT224B is 45%

#assumed α efficiency (4π) for ASP 100 is 20%

‡assumed α efficiency (4π) for SHP380 is 50%
If α efficiencies are different from those assumed above, instrument indications must be re-calculated. Additionally, the use of activity, instead of instrument-specific count rates, will eliminate problems associated with inconsistencies in instrument calibration from facility to facility or from service to service (Air Force, Navy, National Lab, etc.).

HEALTH AND SAFETY

Table 8. Protective Action Guide Hazard Values

Dose Levels	Recommended Actions
> 25 rem	same as below except voluntary only (NARAC > 25 rem contour)
> 5 rem to 25 rem	Workers performing emergency services for saving lives or protecting large populations. (NARAC > 5 rem contour)
1 – 5 rem	evacuate and/or consider sheltering (NARAC > 1 rem contour)
< 1 rem	consider sheltering

HEALTH AND SAFETY

Table 9. Equation for Calculating Resuspension Factors

$$RF = \frac{\text{airborne activity}}{\text{ground activity}} = \frac{dpm / m^3}{dpm / m^2} = m^{-1}$$

HEALTH AND SAFETY

Table 10. Work-Rest Cycles and Fluid Replacement Guidelines

Heat Category	WBGT Index ºF	Light (Easy) Work		Moderate Work		Hard (Heavy Work)	
		Work/ Rest	Water Intake (Quart/hr)	Work/ Rest	Water Intake (Quart/hr)	Work/ Rest	Water Intake (Quart/hr)
1	78-81.9	NL	1/2	NL	3/4	40/20 min	3/4
2 (Green)	82-84.9	NL	1/2	50/10 min	3/4	30/30 min	1
3 (Yellow)	85-87.9	NL	3/4	40/20 min	3/4	30/30 min	1
4 (Red)	88-89.9	NL	3/4	30/30 min	3/4	20/40 min	1
5 (Black)	>90	50/10 min	1	20/40 min	1	10/50 min	1

1. If wearing Mission Oriented Protective Posture 4, add 10º F to WBGT.
2. If wearing personal body armor, add 5º F to WBGT in humid climates.
3. Daily fluid intake should not exceed 12 quarts.
4. Caution: Hourly fluid intake should not exceed one quart.
5. Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
6. NL = no limit to work time per hour.
7. These work/rest time and fluid replacement volumes sustain performance and hydration for at least 4 hours of work in the specified work category. Individual water needs may vary ±1/4 qt/hr.

INCIDENT COMMAND SYSTEM FUNCTIONAL APPENDIX

Table 1. ICS and DoD Staff Equivalency

Incident Command Structure	Applicable DoD Staff Function (J-#)
Incident Commander/(UC)	IRF/RTF Commander
Deputy Commander	Deputy Commander
Chief of Staff	Chief of Staff
Public Information Officer	Public Affairs
Legal Officer	Judge Advocate
Safety Officer	Safety Officer
Protocol Officer	Protocol
Medical Advisor	Medical Advisor
Liaison Officer	Liaison Officers as needed
Operations Section	J-3
Planning Section	J-1, J-2, J-4, J-5
Logistics Section	J-1, J-4, J-6
Finance/Administration Section	J-1, Comptroller

INCIDENT COMMAND SYSTEM FUNCTIONAL APPENDIX

Table 2. Sample Basic Operational Period IAP

Components	Normally Prepared By
Incident Objectives (Form: ICS 202)	Incident Commander
Organization List or Chart (Form: ICS 203)	Resources Unit
Assignment List (Form: ICS 204)	Resources Unit
Communications Plan (Form: ICS 205)	Communications Unit
Responder Medical Plan (Form: ICS 206)	Medical Unit
Incident Map	Situation Unit
General Safety Message	Safety Officer
Other Potential Components (Incident dependent)	
Air Operations Summary	Air Operations
Traffic Plan Ground	Support Unit
Decontamination Plan	Technical Specialist
Waste Management or Disposal Plan	Technical Specialist
Demobilization Plan	Demobilization Unit
Site Security Plan	Law Enforcement, Technical Specialist, or Security Manager
Investigative Plan	Law Enforcement
Evidence Recovery Plan	Law Enforcement
Evacuation/Sheltering Plan	As Required
Other	As Required

INCIDENT COMMAND SYSTEM FUNCTIONAL APPENDIX

TAB A. JFO INCIDENT ACTION PLAN

SITREP #1				
Date/Time (EST)				
Incident Type:				
Location of Incident:				
Time of Incident (EST):				
Incident Site Weather Conditions:	Location	Current	24 hours	48 hours

Threat Levels	
COOP COGCON	
Homeland Security Advisory System (HSAS)	
Maritime Security Level (MARSEC)	
DoD Force Protection Condition (FPCON)	

Threat Assessment and Operational/Investigative Operations	
Intelligence Assessment/Update	
Technical Assessment/Update	
Counter-terror/Law Enforcement Operations Status/Update (non-ESF 13)	

Status of Federal Decisions and National-level Operational Elements	
Presidential Emergency/Disaster Declarations (Stafford Act)	
Principle Federal Official Status	

Joint Field Office Status	

Federal Radiological Monitoring and Assessment Center Status	
Catastrophic Incident Supplement Status	

Current Situation/Summary

Modeling

On-Scene Update	
Official Casualties/Relief Effort	
Fatalities	
Hospitalized	
Injured	
Sheltered	
Extent of Damage	
Destroyed	
Major Damage	
Minor Damage	
Power Outages	

Federal and National Guard Personnel Deployed	
Organization	
USCG	
FEMA Responders	
Federal Law Enforcement (ESF-13)	
National Guard	
US Active Military Duty	
Health and Human Services (ESF-8)	

Federal Assets Deployed	
Asset	
DoD Rotary Wing	
USCG Rotary Wing	
CBP	
Other	
Total Rotary Wing	
DoD Fixed Wing	
USCG Fixed Wing	
CBP Fixed Wing	
Total Fixed Wing	
DoD Ships	
USCG Ships	
Total Ships	

Requests For Assistance/Emergency, Disaster, and Presidential Declarations		
Status of Declarations		
Date	**Declaration**	**Remarks**

Law Enforcement Security Issues (non-ESF operations)		
Borders and Coastal Waters		
Transportation		
Law Enforcement	Federal	
	Regional	
	Local	

Critical Infrastructure Issues/Operational Activities	
Sector Impacts	
Agriculture & Food	
Banking & Finance	
Chemical	
Commercial Facilities	
Commercial Nuclear Reactors, Materials and Waste	
Dams	
Defense Industrial Base	
Drinking Water & Water Treatment	
Emergency Services	
Energy	
Government Facilities	
Information Technology (IT)	
National Monuments and Icons	
Postal & Shipping	
Public Health and Healthcare	
Telecommunications	
Transportation Systems	
Cross-Sector Impacts	

Emergency Response Issues	
Emergency Support Functions (ESF) 1-15 FEMA	
ESF-1 Transportation	**Activated: JFO RRCC NRCC**

ESF-2 Communications	**Activated: JFO RRCC NRCC**

ESF-3 Public Works and Engineering	**Activated: JFO RRCC NRCC**

ESF-4 Firefighting	**Activated: JFO RRCC NRCC**

ESF-5 Emergency Management	**Activated: JFO RRCC NRCC**

ESF-6 Mass Care, Housing and Human Services	**Activated: JFO RRCC NRCC**

Shelter Numbers		
State	**Number of Shelters**	**Remarks**
Total		

ESF-7 Resource Support	**Activated: JFO RRCC NRCC**

ESF-8 Public Health and Medical Services	**Activated: JFO RRCC NRCC**

ESF-9 Urban Search and Rescue	**Activated: JFO RRCC NRCC**

ESF-10 Oil and Hazardous Materials Response	**Activated: JFO RRCC NRCC**

ESF-11 Agriculture and Natural Resources	**Activated: JFO RRCC NRCC**

ESF-12 Energy	**Activated: JFO X RRCC X NRCC X**

ESF-13 Public Safety and Security	**Activated: JFO X RRCC X NRCC X**

FEMA Safety	Activated: JFO RRCC NRCC

ESF-14 Long-Term Community Recovery	Activated: JFO RRCC NRCC

Mitigation	Activated: JFO RRCC NRCC

ESF-15 External Affairs	Activated: JFO RRCC NRCC

Emergency Management Assistance Compact (EMAC)

Department of Defense (DoD)

Potential Additional Future Federal Responses Anticipated

Non-Governmental Assets Currently Not Addressed in ESF 6 (Type/Number)

International Issues

Joint Information Dissemination/Public Affairs Plan and/or Releases

Donations Activities

Additional Remarks

INTER-DOD FUNCTIONAL APPENDIX

Table 1. Organizations with Cooperating Agency Responsibilities

Department of Agriculture	Department of Commerce
Department of Energy	Department of Health & Human Services
Department of Homeland Security	Department of Housing & Urban Development
Department of the Interior	Department of Justice
Department of Labor	Department of Transportation
Department of Veterans Affairs	Environmental Protection Agency
Department of State	Nuclear Regulatory Commission
General Services Administration	American Red Cross

MEDICAL

Table 1. Guidelines for Bioassay Sampling

Suspected Radioactive Material	Feces Optimum Sampling Time After Exposure	Urine Optimum Sampling Time After Exposure	Sample Quantity
Plutonium	2 to 3 days	2 to 3 weeks	24 hours total
Uranium	2 to 3 days	24-48 hours	24 hours total
Tritium	N/A	4 to 8 hours	1 voiding

MEDICAL

Table 2. Guidelines for Assigning Priorities for Collecting and Processing Bioassays

Alpha Contamination Level on Clothing or Skin

Priority	60 cm^2 (45% eff)	17 cm^2	100 cm^2 (50% eff)	100 cm^2 (20% eff)
HIGH	> 300,000 cpm	> 85,000 cpm	> 550,000 cpm	> 222,000 cpm
MEDIUM	30,000-300,000 cpm	8,500-85,000 cpm	55,000-550,000 cpm	22,200-222,000 cpm
LOW	< 30,000 cpm	< 8,500 cpm	< 55,000 cpm	< 22,200 cpm

MEDICAL

Table 3. Sample Instrument Readings to Determine Bioassay Priority in Table 2.

Instrument	Probe (area in square cm)	Activity (microCurie/100 square cm)	Instrument indication
AN-PDR-56	*DT224B (17)	0.5	~85,000 cpm
ADM-300	#ASP 100 (100)	0.5	~222,000 cpm
E-600	‡SHP 380 (100)	0.5	~550,000 cpm
AN-PDR-56	*DT224B (17)	0.05	~8,500 cpm
ADM-300	#ASP 100 (100)	0.05	~22,200 cpm
E-600	‡SHP 380 (100)	0.05	~55,000 cpm

"High" contamination should be defined as "at or above 0.5 uCi/100 cm^2" (or similar)

"Medium" contamination should be defined as "between 0.05 and 0.5 uCi/100 cm^2" (or similar)

"Low" contamination should be defined as "below 0.05 uCi/100 cm^2" (or similar)

*assumed α efficiency (4π) for DT224B is 45%

#assumed α efficiency (4π) for ASP 100 is 20%

‡assumed α efficiency (4π) for SHP380 is 50%

If α efficiencies are different from those assumed above, instrument indications must be re-calculated. Additionally, the use of activity, instead of instrument-specific count rates, will eliminate problems associated with inconsistencies in instrument calibration from facility to facility or from service to service (Air Force, Navy, National Lab, etc.).

RADIATION DETECTION AND MOVEMENT

Table 1. Commonly Considered Radioactive Contaminants and Their Primary Associated Radioactive Emissions

	Alpha	Beta	Photons
Am-241	X		X
H-3		X	
Pu-239	X		X
Thorium Alloys	X	X	X
U-Natural	X	X	X
U-Depleted	X	X	X
U-Highly Enriched	X	X	X

RADIATION MONITORING EQUIPMENT

Table 1. Alpha Survey Instruments

Alpha Survey Instruments				
Instrument	**Type**	**Scale**	**Indicator**	**Description**
AN/PDR-56	Scintillation	0 to 1000K, 4 ranges	CPM/100cm2	Small auxiliary probe provided for monitoring irregular objects. Mylar® probe face is very fragile; a puncture disables the instrument. Accompanying X-ray probe is calibrated for 17 kilo electron volt (keV) with associated meter scale from 0 to $10/m^2$ in four ranges.
AN/PDR-77	Scintillation	0 to 999K CPM Digital Auto Ranging	$123cm^2$	See the instrument sets in table AP7.T3.
ADM-300 (with alpha probe AP-100A)	Scintillation	0 to 1.2M CPM	CPM; microcuries per meter squared ($\mu Ci/m^2$); dintegrations per minute (DPM) per $123\ cm^2$	Portable alpha probe with three units of alpha measurement possible. High-range.
PRM-5	Scintillation	0 to 500K, 4 ranges	CPM	Portable, high- and low-range instrument for detecting plutonium contamination by measuring associated X rays and low-energy gamma radiation. Effective in inclement weather and much less subject to damage during field use.
Ludlum Model 3 (See table AP7.T2., below)	Scintillation	0 to 400K	CPM	Portable, high- and low-range instrument. Similar in operation and function to the AN/PDR-60.
Ludlum Model 2220	Scintillation	0 to 500K, 4 ranges	CPM	Liquid crystal display and integral digital readout.

RADIATION MONITORING EQUIPMENT

Table 2. Beta and Gamma Survey Instruments

Beta and Gamma Survey Instruments				
Instrument	**Type**	**Scale**	**Indicator**	**Description**
AN/VDR-2	GM	Digital Auto Ranging 0 to 9.99Gy/hr	Gy/hr	Portable beta and/or gamma survey instrument. Displays total accumulated dose or dose rate. (Replaces the AN/PDR-27 for Army applications.)
AN/PDQ-1	GM	1 Milliroentgen(mR)/h to 1000R/hr	R/hr	Uses ancillary probes; Detecting Head (DT)-680 for gamma/beta, DT-685 for beta probe interface, DT-681 for alpha, DT-682 for X ray, DT-683 for Neutron Indicator, DT-684 for Neutron, DT-686 for Radiography.
AN/PDQ-2	GM	1 mR/hr to 1000 R/hr	R/hr	Uses ancillary probes; DT-680 for gamma/beta, DT-685 for beta probe interface, DT-681 for alpha, DT-682 for X ray, DT-683 for Neutron Indicator, DT-684 for Neutron, DT-686 for Radiography.
AN/PDR – 78	Photo Multiplier	30 keV to 1.6 million electron volts (MeV)	Detector only. Uses an indicator light.	For underwater use to 300 feet.
Ludlum Model 3 (See table AP4.T1.)	GM	0 to 200 mR/hr	mR/hr	Portable high- and low-range analyzer similar to AN/PDR-60. Probe 44-6 uses a GM tube to detect beta and gamma. Probe 44-9 detects low-energy gamma, 0 to 200 mR/hr. Both the 44-9 and 44-6 are sensitive to photon and medium & high energy☐-particle radiations. The 44-9 has an active area of 15.5 cm^2 and is sensitive to low-energy ☐-and ☐-particles because the entrance window is sufficiently thin, i.e. 1.7 ± 0.3 mg/cm^2.
AN/PDR-27	GM	0 to 500; 4 ranges	mR/hr	Low-range; suitable for personnel monitoring for beta and/or gamma emitters only. Not useful for alpha emissions. May saturate and read 0 in high radiation fields above 1,000 R/hr.

Beta and Gamma Survey Instruments				
Instrument	**Type**	**Scale**	**Indicator**	**Description**
AN/PDR-43	GM	0 to 500; 3 ranges	R/hr	High-range; does not saturate in high radiation area. Readings in gamma fields other than Co-60 may be inaccurate to greater than 20 percent.
Army, Navy/General Utility, RADIAC, Passive Detecting-13	1 GM tube. Pin Diode / Prompt Gammas	.01-999 1 – 999	cGy/hr	As a rate meter, it measures residual gamma radiation. As a tactical dosimeter, it measures prompt radiation and residual dose.
ADM-300A	GM	Gamma: 10 to 10,000 Beta: 10 to 5	μR/hr R/hr μR/hr R/hr	Portable beta and/or gamma survey instrument (with beta probe-100 or beta gamma probe (BGP)-100). Built in beta gamma detection and monitoring capability without additional probes. High-range. BGP-100 may be up to 300 feet from the ADM-300. Saturation level of 100,000 R/hr.

RADIATION MONITORING EQUIPMENT

Table 3. Instrument Sets

Instrument Sets	
Instrument	**Description**
AN/PDR-77 RADIAC Set	The AN/PDR-77 shall accept a maximum of eight different probes. Each probe is automatically recognized and has unique calibration information stored in non-volatile memory. The AN/PDR-77 comes with three probes. A 123cm^2 Zinc Sulfide (ZnS) alpha probe, a two Geiger tube beta and/or gamma probe, and a 5-inch Sodium Iodide (NaI) low-energy X ray probe able to measure and find surface contamination levels of Plutonium and Americium (Am)-241 in μCi/m^2. An accessory kit is available that contains a GM pancake probe and a 1" x 1.5" NaI micro-R probe.
Violinist III - FIDLER Instrument Set	Includes the FIDLER, high-voltage power supply, pre-amplifier, and the Violinist III. The Violinist III consists of a battery operated 256-channel analyzer and a pre-programmed microprocessor. When calibrated appropriately, it measures and determines surface contamination levels of Plutonium and Am-241 in μCi/m^2.
Ranger	Includes the FIDLER (Field Instrument for the Detection of Low-Energy Radiation), a positioning determining system (GPS) , and a hand-held data collection platform (4096 MCA and PDA). The FIDLER is specifically designed to detect the low-energy (17- and 60- keV) photons associated with plutonium and americium. The system can be used as a stand-alone data collection unit (storing data on internal compact-flash cards) or as a system consisting of a base station and mobile field units. The mobile units send FIDLER radiation data along with the positional data to the base station for subsequent graphical display. The surface radiation ground deposition values are displayed in near real time. Ranging is typically limited to near line of sight, roughly about 5 miles, but dense vegetation, buildings, and hills can affect the signal. The current system can also use various other low-resolution gamma detectors coupled to the MCA unit allowing for identification and determination of surface contamination from numerous radionuclides.
Berkeley Nucleonic Corp SAM-935	The SAM-935, as equipped for AF units, have an external 2 x 2 NaI(Tl) detector with a multi-channel analyzer capable of isotope identification based on discrete energy photon emissions.

RADIATION MONITORING EQUIPMENT

Table 4. Tritium Survey Instruments

Tritium Survey Instruments			
Instrument	**Scale**	**Indicator**	**Description**
T-446	0 to 10	Microcuries per cubic meter ($\mu Ci/m^3$)	Portable, automatic scale switching, trickle charger for Nickel Cadmium F-sized cells. With adapter kit, has urinalysis capability with 5-minute response. Filters particulate to .3 microns; not sensitive to smoke and paint fumes.
AN/PDR-73	0 to 10K; four ranges	$\mu Ci/m^3$	Portable air monitor comprising radiacmeter Intensity Measuring (IM)-245/Portable Detector Radiation, designed to detect gaseous radioactive contamination in the ambient air. The instrument is capable of continuous air sampling and is calibrated to read directly the level of tritium. Powered by twelve internal rechargeable "C" cell batteries or by 115 Alternating Current Volt, 60 Hz when in continuous use.
AN/PDR-74	0 to 100K; three ranges	$\mu Ci/m^3$	The portable RADIAC set contains an IM-246 air monitor to detect gases. Calibrated in terms of tritium activity but may be used to monitor other radio gases. Powered by "D" cell batteries. Alarm sounds at preset meter reading.

RADIATION MONITORING EQUIPMENT

Table 5. Dosimeters

Dosimeters	
Instrument	**Capability and Limitations**
Self-Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to X rays and gamma radiation. May provide false positive readings due to charge leakage and sensitivity to mechanical shock.
Non-Self- Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to X rays and gamma radiation. May provide false positive readings due to charge leakage and sensitivity to mechanical shock. Requires separate reading device.
Film Badge	Provides measurement and permanent record of beta and gamma doses over a wide dosage range. Special neutron films are available. 10 percent dose accuracy depending on quality control (QC) during development. Sensitive to light, humidity, aging, and exposure to X rays. Delay between exposure and dose reading due to processing time.
Thermo-Luminescent Dosimeter (TLD)	Measures gamma radiation dose equivalents up to 10,000 rem. Accurate to within a factor of two when the energy of the neutrons is unknown. After long periods of exposure, damaged or bent cards delay processing, static electric discharge causes spurious readings, and temperatures greater than 115°F reduce sensitivity. Delay between exposure and dose reading due to central processing of TLDs.
Electronic Personal Dosimeter	Detects and measures gamma, beta, and X-ray radiation. Most have an audible alarm as well as a digital readout. There are many models available on the market. Specifications vary from system to system.