

Table 2. Air-quality in forest fires: Decision chart for crisis managers










		(1)	(2)	(3)	(4)	(5)		(6)	(7)
Road-map of forest fire flame front and smoke pathway	Forest Fire flame-front pathway 	Rural Fields  	Rural or Urban Constructions 	Waste Disposal 	Illegal Waste Disposal 	Suppression by aerial means 	Smoke front pathway	Urban Area 	Industrial Urea 
Scenarios	Pyrolysis and combustion of forest fuel	Pyrolysis and combustion of agricultural fields, fungicides, fertilizers, pesticides e.g. 4-chloro-2-methyl phenoxy acetic acid (MCPA)	Pyrolysis and combustion of paint, glue, wood, plastics) Glass, cement, plaster, asbestos can be contained in the smoke produced	Pyrolysis and combustion of household waste, plastic, rubber, paper, Glass and metals can be contained in the smoke produced	Pyrolysis and combustion of organic residues, lead-acid vehicle batteries, electric appliances, radioactive materials	Pyrolysis and combustion of diammonium phosphate (DAP), ammonium sulfate & other commercial fire retardants Sea Water (Na, Cl)		Mixing of forest fire smoke with urban pollutants, possible photochemical reactions	Mixing of forest fire smoke with industrial pollutants, possible photochemical reactions
Chemical Species/ Smoke components	Organic VOCs (Hydrocarbons, Aldehydes, furans, carboxylic acids, BTEX), SVOCs (PAHs) Inorganic CO, CO ₂ , NO _x , SO _x Particulates Coarse (PM ₁₀) & Fine (PM _{2.5})	Organic VOCs, SVOCs (PAHs), PCDDs, PCDFs Inorganic CO, CO ₂ , CH ₄ , HCl, SO ₂ , NO _x , PO _x , NH ₃ , CS ₂ , H ₂ S, HCN Particulates Coarse (PM ₁₀) & Fine (PM _{2.5})	Organic Non polar VOCs (e.g BTEX, styrene), SVOCs (PAHs), PCDDs, PCDFs, PCBs Inorganic CO, CO ₂ Particulates Coarse (PM ₁₀) & Fine (PM _{2.5})	Organic VOCs, chloro-benzenes, chloro-phenols, SVOCs (PAHs), Carbonyls, PCDDs, PCDFs, PCBs Inorganic CO, CO ₂ Particulates Mainly Fine particles (PM _{2.5} <)	Organic PCDDs, PCDFs, Co-PCBs Inorganic CO, CO ₂ ,	Inorganic NH ₃ , SO ₂ Particulates Mainly fine particles (PM _{2.5} <)		Organic Aliphatic H/C, VOCs, BTEX, Styrene, PAHs, Saturated hydrocarbons (PAR), Furans, PCDDs/PCDFs Inorganic CO, CO ₂ , NO _x , SO ₂ , H ₂ S, O ₃ Particulates Coarse (PM ₁₀) & Fine (PM _{2.5})	Organic Inorganic Aliphatic H/C, VOCs, BTEX, Styrene, PAHs, Saturated hydrocarbons (PAR), mercaptans, PCDFs Inorganic CO, CO ₂ , NO _x , SO ₂ , H ₂ S, O ₃ Particulates Coarse (PM ₁₀) & Fine (PM _{2.5})

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Liquid-solid phase	Soot, tars, SVOCs, particles	Soot, tars, SVOCs, carbonized particles	Condensation of aerosols, smoke particles	Particulate pollutants	Ash	Salts, increased amounts of residual char Soot, tars, particles		Organic aerosols, vapor-phase organics, tar, organometallic dust, particles	Atmospheric aerosols, Total Suspended Particles (TSP), Dust
Chemical Composition of particles	Organic Carbon (OC), Elemental Carbon (EC), Total Carbon (TC), Trace Elements: cations (K, Na, Fe, Cu, Al, Si, Cr), Anions (F, Cl, N, S) alkaline earth metals (Ca, Mg, Zn, Mn), heavy metals (As, Cd, Ni, V, Hg, Pb)	High molecular weight toxic species absorbed on smoke particles	NiCl ₂ , PbCl ₂ , VCl ₄ , SiCl ₄ Pb, Cu, Zn, S, Cl, Ca, Mg, Ti, Al	PbCl ₂ , VCl ₄ , SiCl ₄ Pb, Cu, Zn, S, Cl, Cd, Cr, Cu, Zn	Radionuclides (I-29, Cs-137, Cl-36)	NaCl (NH ₄) ₃ PO ₄		SiO ₂ , Al ₂ O ₃ , Ca, Mg, Ba, Cu, Sn, Iron compounds, S, V, C	Fe, Mn, Cd, Zn, Ca, Ti, Fe, Cu, Cr, Al, Ni, K, Na, Mo, Co, Cd, Pb
Chemical Properties			Alcaline (pH 9-11.5) (Ca(OH) ₂ , CaCO ₃ , CaSO ₄)					pH < 9 Photochemical reactions (PAH photo-degradation, Photo-chemical O ₃)	pH < 9 Photochemical reactions (PAH photo-degradation, Photo-chemical O ₃)

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Physical properties (Physical state, Color, Visibility, Odor, Shape)	Vapors, Vapors and/or Particulates, Particulates (at ambient conditions)	Aerodynamic diameters of the smoke particles affect smoke transport more than the physical particle size	Solid grey to black particles	Dry deposition Wet deposition (rain snow, fog)					
METEO Temper. Effect Wind Effect Sun Effect Rain Effect				Air temperature during sampling (25 – 800 oC) Wind speed and direction, humidity				Photochemical reactions(H/C reaction with OH ⁻ in NO _x and sunlight presence)	Air temperature Wind speed and direction, rainfall Photochemical reactions(H/C reaction with OH in NO _x and sunlight presence)
OPERATIONAL Land Shape Severity (I, II, III)		Highly contaminated aerosol with serious health implications		Sampling at different sites around the fire front (Different concentrations)		Different NH ₃ concentrations at different sampling points			Epidemiological issues, Health effects
Health symptoms/PPE Field Analysis	Serious effect of respiratory system			Necessary the use of respiratory equipment by the fire-fighters		Necessary the use of masks by the fire-fighters in the vicinity of the fire			