Code for Model 1A: First Responders’ willingness to enter an area with radioactive contamination

```plaintext
breed [doctors doctor] ;; designates the first responder agents

doctors-own [
     my-neighbors
     nearest-neighbor
     flockmates
     mineRadiationTolerance
  ]

patches-own [
     falloutZone? ;; this variable report TRUE or FALSE if a patch is within the designated falloutZone
     radiation ;; a radiation variable is included in the background environment within the contaminated area
     pointsourceRad ;; an additional pointsource of radiation is overlapped within the contaminated area
  ]

to setup
   clear-all
   setup-patches
   setup-doctors
   reset-ticks
end

;; this command series determines the visual characteristics of the first responder agents and restricts generation of only one agent per patch area and also determines the “mineradiationtolerance” numerical value representative of the assigned personal perception radiation risk

to setup-doctors
   set-default-shape doctors "person doctor"
   ask n-of initial-number-FirstResponders
      (patches with [pxcor > -40 and pycor < -18] )
      [ sprout-doctors 1 ]

   ask doctors [
      set color green
      set mineRadiationTolerance random-poisson 2.5
      if mineRadiationTolerance < 1
         [set mineRadiationTolerance 1]
      if mineRadiationTolerance > 5
         [set mineRadiationTolerance 5]
   ]
end
```
;;this command series determines the background setup of the model and includes a series of commands affecting patches

to setup-patches
  ask patches [ 
    set pcolor 69
    set plabel-color black
    setup-pointsource
    setup-falloutZone?
    setup-radiation
    ask patch 35 28 [set plabel "Contaminated Zone"]
  ]
end

to go
  move-doctors
  flock1
  move-doctors1
  set-master-heading
  move-doctors1
  reset-heading
  move-doctors1
  flock1
  move-doctors1
  tick
end

;;this command series directs the first responder agents to move towards the area with radioactive contamination at varying speed based on their respective mineRadiationTolerance score, if they have a higher mineradiationtolerance individual score they move faster

to move-doctors
  let slowest 0.00000000000000000001
  let slow 0.0002
  let fast 0.0004
  let fastest 0.0006
  ask doctors [ 
    show-radiation-dread
    if mineRadiationTolerance < 1.5
      [fd slowest]
    if ((mineRadiationTolerance >= 1.5) and (mineRadiationTolerance < 2.5))
      [fd slow]
if (mineRadiationTolerance >= 2.5 and mineRadiationTolerance < 4))
    [fd fast]
    if mineRadiationTolerance >= 4
        [fd fastest]
    }
end

;;this tells the agents to communicate the mean mineRadiationTolerance variable to each other

to-report average_mineRadiationTolerance
    let myRT mean [mineRadiationTolerance] of flockmates
    report mean myRT
end

;;this tells the first responder agents to consider the mean mineRadiationTolerance of their neighbors
and move faster towards the area with radioactive contamination if that value is >= 2.5

to move-doctors1
    let speed_gungho 0.02
    ask doctors [show-radiation-dread]
    if falloutZone? = True [set speed_gungho .3 * speed_gungho]
    let F count flockmates
    if F > 0
        [ let myRT mean [mineRadiationTolerance] of flockmates
            if myRT >= 2.5
                [fd speed_gungho]
        ]
    ]
end

;;this directs the agents to move in a northern direction towards the area with radioactive contamination

to set-master-heading
    ask turtles [set heading 2]
end

;;this directs the agents to reset their direction to a random point

to reset-heading
    ask turtles [set heading random 10
                   fd 0.02]
end
;;;;;;;;this directs the agents to look and see if they have any neighbors and move towards them

to flock1
  ask doctors [  
;;;;this command line doesn't affect the agent behavior the model is designed to simulate
    let myx mineRadiationTolerance
    find-flockmates
    if any? flockmates
      [ find-nearest-neighbor
        ifelse mineRadiationTolerance >= myx
          [align cohere]
          [separate]
      ]
    ]
  ]
end

;;;;this directs first responder agents to consider their neighbors or "flockmates" within whatever distance
the Communication variable is set to

to find-flockmates
  set flockmates other turtles in-radius Communication
end

;;;;this directs the agents to locate their nearest neighbor

to find-nearest-neighbor
  set nearest-neighbor min-one-of flockmates [distance myself]
end

;;;;this directs the agents to move away from their nearest neighbor

to separate
  turn-away ([heading] of nearest-neighbor) 2.0
end

;;;; this directs the agents to move towards their neighbors

to align
  turn-towards average-flockmate-heading 2.0
end

;;;; this directs the agents to keep moving relative to their neighbors

to cohere
  turn-towards average-heading-towards-flockmates 2.0
end
;this directs the agents to communicate the mean directional heading of their neighbors and is referenced from the flocking model in the NetLogo library of models

;to-report average-flockmate-heading

let x-component sum [dx] of flockmates
let y-component sum [dy] of flockmates
ifelse x-component = 0 and y-component = 0
  [ report heading ]
  [ report atan x-component y-component ]
end

;this directs the agents to communicate the mean directional heading of themselves towards their neighbors

;to-report average-heading-towards-flockmates

let x-component mean [sin (towards myself + 180)] of flockmates
let y-component mean [cos (towards myself + 180)] of flockmates
ifelse x-component = 0 and y-component = 0
  [ report heading ]
  [ report atan x-component y-component ]
end

;these following commands direct "flocking" movement of the agents like birds or "boyds"
the agents move continually with respect to each other

;to turn-towards [new-heading max-turn]
  turn-at-most (subtract-headings new-heading heading) max-turn
end

;to turn-away [new-heading max-turn]
  turn-at-most (subtract-headings heading new-heading) max-turn
end

;to turn-at-most [turn max-turn]
ifelse abs turn > max-turn
  [ ifelse turn > 0
    [ rt max-turn ]
    [ lt max-turn ]
  ]
  [ rt turn ]
end

;these following commands direct the first responders to respond to the presence of radiation within the contaminated area with directed movement to pause redirect their heading and move forward until they find an area with less radiation

;to show-radiation-dread
ask doctors [  
  if ((radiation >= 9 or pointsourceRad >= 9) and mineRadiationTolerance >= 2.5)  
    [wiggle]  
  if ((radiation >= 9 or pointsourceRad >= 9) and mineRadiationTolerance < 2.5)  
    [wiggle1]  
]  
]

;; directs "wiggle" movement of agents to turn right 40 degrees in a random direction and move back 2 patches

to wiggle  
  back .1  
  rt random 40 - 80  
  forward .2  
end

to wiggle1  
  back .1  
  rt random 40 - 80  
  forward .1  
end

;; these commands direct setup of the background environment within the model

to setup-radiation  
  if falloutZone? [  
    set radiation random-poisson 9  
    set pcolor scale-color red radiation 50 0  
  ]  
end

to setup-pointsource  
  set pointsourceRad 17 - distancexy 0 30  
  set pcolor scale-color orange pointsourceRad 30 0  
  if (pointsourceRad <= 0) [ set pcolor 69]  
  if (pointsourceRad < 0) [ set pointsourceRad 0]  
end

to setup-falloutZone?  
  set falloutZone?  
  random pycor > 10  
end