APPENDIX A-VIII

EARTHQUAKES

CHECK LIST FOR NON-STRUCTURAL COMPONENTS FOR EARTHQUAKES

This Appendix constitutes a list of items and issues to be considered in designing the non-structural components of healthcare facilities to counteract the effects of earthquakes. Check lists are valuable as *aides-memoire* for the exercise. For any particular project all of the items may not be relevant, but excluding items from a comprehensive list is always easier than adding relevant items to a short list.

1. **Electricity**
   
   1.1 Generator
      
      1.1.1 Anchorage of the emergency generator
   
   1.2 Batteries
      
      1.2.1 Attachment of the batteries to the battery rack
      1.2.2 Cross-bracing the rack in both directions
      1.2.3 Battery rack bolted securely to a concrete pad
   
   1.3 Diesel Fuel Tank
      
      1.3.1 Attachment of the tank to the supports
      1.3.2 Cross-bracing the tank supports in both directions
      1.3.3 Bracing attached with anchor bolts to a concrete pad
   
   1.4 Fuel Lines and Other Pipes
      
      1.4.1 Lines and pipes attached with flexible connections
      1.4.2 Able to accommodate relative movement across joints
   
   1.5 Transformers, Controls, Switchgear
      
      1.5.1 Items properly attached to the floor or wall
   
   1.6 Bus Ducts and Cables
      
      1.6.1 Able to distort at their connections to equipment without rupture
      1.6.2 Able to accommodate relative movement across joints
      1.6.3 Laterally braced

2. **Fire Fighting**

   2.1 Smoke Detectors and Alarms
      
      2.1.1 Properly mounted
      2.1.2 Control system and fire doors securely anchored
2.2 Fire Extinguishers and Hose-reel Cabinets
   2.2.1 Cabinets securely mounted
   2.2.2 Extinguishers secured with quick-release straps

2.3 Emergency Water Tank
   2.3.1 Securely anchored to its supports
   2.3.2 Supports braced in both directions
   2.3.3 Supports of braces anchored to a concrete foundation

3 Propane Tanks
   3.1 The Tank
      3.1.1 Securely anchored to its supports
      3.1.2 Supports braced in both directions
      3.1.3 Supports or braces anchored to a concrete foundation

3.2 Shut-off Valve
   3.2.1 System with an automatic, earthquake-triggered, shut-off valve
   3.2.2 Laterally braced

4 Plumbing
   4.1 Water Heaters and Boilers
      4.1.1 Securely anchored to the floor or wall
      4.1.2 Gas line with a flexible connection to the heater or boiler to accommodate movement

   4.2 Pumps
      4.2.1 Anchored or mounted on vibration isolation springs with seismic lateral restraints

   4.3 Hot and Cold-water Pipes and Wastewater Pipes
      4.3.1 Pipes laterally braced at reasonable intervals
      4.3.2 Flexible connections to boilers and tanks
      4.3.3 Able to accommodate movement across joints
      4.3.4 Pipe penetrations through walls large enough for seismic movement
      4.3.5 Free of asbestos insulation (which can be broken in an earthquake)

4.4 Solar Panels
   4.4.1 Securely anchored to the roof

5 Elevators
   5.1 Cab
      5.1.1 Properly attached to the guide rails
      5.1.2 Alarm system for emergencies

   5.2 Cables, Counterweights, Rails
      5.2.1 Cables protected against misalignment during an earthquake
      5.2.2 Counterweights properly attached to guide rails
5.2.3 Guide rails properly attached to the building structure

5.3 Motors and Control Cabinets
5.3.1 Anchored

6 Air Conditioning
6.1 Chillers, Fans, Blowers, Filters, Air Compressors
6.1.1 Anchored, or mounted on vibration isolation springs with seismic lateral restraints

6.2 Wall-mounted Units
6.2.1 Securely mounted

6.3 Ducts
6.3.1 Laterally braced
6.3.2 Able to accommodate movement at locations where they cross separation joints

6.4 Diffusers
6.4.1 Grills anchored to the ducts or to the ceiling grid or to the wall
6.4.2 Hanging diffusers adequately supported

7 Non-structural Walls and Partitions
7.1 Concrete Block, Brick, Clay Block
7.1.1 Reinforced vertically and/or horizontally
7.1.2 Detailed to allow sliding at the top and movement at the sides
7.1.3 Restrained at the top and the sides against falling

7.2 Stud-wall and other Lightweight Walls
7.2.1 Partial-height partitions braced at their top edges
7.2.2 If they support shelving of cabinets, securely attached to the structure of the building

8 Ceiling and Lights
8.1 8.1.1 Suspended ceilings with diagonal bracing wires
8.1.2 Plaster ceilings with the mesh of wood lath securely attached to the structure above

8.2 Lighting
8.2.1 Light fixtures (e.g. lay-in fluorescent fixtures) with support independent of the ceiling Grid
8.2.2 Pendant fixtures with safety restraints (e.g. cables) to limit sway
8.2.3 Emergency lights mounted to prevent them falling off shelf supports

9 Doors and Windows
9.1 Doors
9.1.1 If exit doors are heavy metal fire doors that might jam in an earthquake, provision of a Crowbar of sledge hammer readily available to facilitate emergency opening
9.1.2 Automatic doors with manual overrides
9.1.3 Directions in which the doors swing

9.2 Windows
9.2.1 Glazing designed to accommodate lateral movement
9.2.2 Large windows, door transoms and skylights with safety glass

10 Appendages and Sundries
10.1 Parapets, Veneer and Decoration
10.1.1 Parapets reinforced and braced
10.1.2 Veneers and decorative elements with positive anchorage to the building

10.2 Fences and Garden Walls
10.2.1 Designed to resist lateral forces
10.2.2 Masonry walls reinforced vertically and rigidly fixed to their bases

10.3 Signs and Sculptures
10.3.1 Signs adequately anchored
10.3.2 Heavy and/or tall sculptures anchored to prevent overturning

10.4 Clay and Concrete Roof Tiles
10.4.1 Tiles secured to the roof with individual fixings for each tile

11 Movable Equipment
11.1 Communications
11.1.1 Radio equipment restrained from sliding off shelves
11.1.2 Telephones placed away from edges of desks and counters
11.1.3 Elevated loud speakers and CCTV anchored to the structure

11.2 Computers
11.2.1 Vital computer information backed up regularly and stored off site
11.2.2 Heavy computer equipment of significant height relative to width anchored or braced
11.2.3 Desktop items prevented from sliding off tables
11.2.4 Access floors braced diagonally or with seismically-certified pedestals

11.3 Storage of Records and Supplies
11.3.1 Shelving units anchored to walls
11.3.2 Shelves fitted with edge restraints of cords to prevent items from falling
11.3.3 Heavier items located on the lower shelves
11.3.4 Filing cabinet drawers latched securely
11.3.5 Heavily-loaded racks braced in both directions
11.3.6 Fragile valuable items restrained from tipping over
11.3.7 Chemical supplies secured or stored in “egg crate” containers

11.4 Hazardous Items
11.4.1 Gas cylinders tightly secured with chains at top and bottom (or otherwise)
11.4.2 Chemicals stored in accordance with manufacturers recommendations
11.4.3 Cabinets for hazardous materials given special attention with respect to anchoring

11.5 Furniture
11.5.1 Heavy potted plants restrained from falling or located away from beds
11.5.2 Beds and tables and equipment with wheels provided with locks or other restraints to Prevent them rolling unintentionally