INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
34100 TRIESTE (ITALY) - P.O.B. 586 - MIRAMARE - STRADA COSTIERA 11 - TELEPHONE: 2240-1
CABLE: CENTRATOM - TELEX 460392-1

SMR.300 - 8

COLLEGE ON MEDICAL PHYSICS

10 October - 4 November 1988

A Hospital Version of CMPH

C. TAYLOR
IAEA, Vienna, Austria

A hospital version of CMPM

1. "CMPM" means "Computerised Management of Preventive Maintenance". It is a computer program developed in a research programme of the International Atomic Energy Agency (IAEA) to help nuclear research laboratories to manage and maintain their stocks of scientific instruments.

2. CMPM includes a built-in "Policy Matrix" which states the Preventive Maintenance (PM) requirements for different types of nuclear instrument. The types of instrument, and the servicing requirements, were agreed during the research programme. Thus, CMPM knows how much time is needed to service each type of instrument, and how often the servicing should be done (once a year, every two months, etc). A handbook associated with CMPM lists the service actions for each type of instrument. See Appendix 1 for two sample pages from this handbook.

3. But all this is for mainly nuclear instruments. It would be possible to modify CMPM to make it apply to instruments and equipment used in hospitals. It is proposed to work on this problem during the College.

4. Appendix 2 shows the types of equipment covered by the present, nuclear, version of CMPM. It will be seen that there are 10 "groups", or categories, of equipment (for example "Analytical Instruments"). In each group there are 9 "types" of equipment (for example, "Gas Chromatograph").

5. Can we work out an equivalent list for hospital equipment and instruments ? A commercial computer program, HECS ("Hospital Equipment Control System") has this for American hospitals, see Appendix 3. Is this list suitable for hospitals in less developed countries ?

6. A longer list is shown in Appendix 4. This is a general listing of equipment currently in use in Italian hospitals. It may give some ideas for making a new policy matrix for CMPM.

C. Taylor
Vienna

Examples of pages from CMPM's Preventive Maintenance Handbook

PREVENTIVE MAINTENANCE PROCEDURE

3. RADIATION SURVEY-METER

LEVEL ONE — FREQUENCY: DAILY — TIME REQUIRED: 0,1 HR.

a./ Check battery with built-in tester.

b./ Check nuclear response with test source. Check background.

c./ Enter results into wall-chart.

LEVEL TWO — FREQUENCY: SIX / YEAR — TIME REQUIRED: 0,5 HR.

a./ Remove battery,check its condition,replace if short circuit current is less then one Amper.Clean battery compartment.

b./ Check sensitivity in all ranges with standard source and geometry.Enter findings into wall-chart.

c./ Record current up-take at nominal battery voltage in selected range while irradiated with standard source in fixed geometry.

d./ Check mechanical condition of cables,connectors,switches and meter mechanical zero setting if any.

LEVEL THREE — FREQUENCY: TWO / YEAR — TIME REQUIRED: 1 HR.

a./ Check instrument for corrosion,mechanical wear of components repair if needed.

b./ Calibrate instrument.Enter observations on sensitivity changes since last calibration.Propose modification of calibration cycles if necessary.

c./ Check spares and consumables,place order if quantity is insufficient for next period.Propose replacement if needed.

d./ Enter findings into log-book.

PREVENTIVE MAINTENANCE PROCEDURE

71. OVEN,HOT-PLATE,DRYER,THERMOSTAT

LEVEL ONE PREQUENCY: POUR/YEAR TIME REQUIRED: 0,5 HR.

a./ Check condition and tightness of cable joints,operation of switches,grounding.Check operation of temperature control action if any.

b./ Enter observations into log-book and action on wall-chart.

LEVEL TWO PREQUENCY: TWO/YEAR TIME REQUIRED: 1 HR.

a./ Check current up-take and insulation in hot condition,voltage drop on switches with full-load.Repair,replace as needed.

b./ Clean unit. Check electrical noises generated,repair if needed.

c./ Enter observations into log-book and activity into wall-chart.

LEVEL THREE PREQUENCY: ONE/YEAR TIME REQUIRED: 1 HR.

a./ Check safety features / insulation,grounding,door operation etc./

b./ Check calibration of thermostat switch if any.

c./ Evaluate condition of unit,propose overhaul or replacement.

d./ Check spares and consumables,procure for next period if needed.

e./ Enter findings into log-book and wall-chart.

CMPM classification of nuclear equipment

0. NUCLEAR SAFETY
1. ALARM/NUCL. FIRE
2. POCKET DOSEMETER
3. GAMMA SURVEY M.
4. ALPHA/BETA CONT.
5. NEUTRON DOSE M.
6. TLD
7. AIR/LIQ. MONITOR
8. BODY/HAND/FOOT M.
9. DECONTAM. KIT

10. PRESERVATION
11. SAFETY CIRC./SW.
12. LAB. ENVIRONMENT
13. DEHUM./AIR-CON.
14. D.O. REL. VARIST.
15. CVT
16. NETWORK/GROUND
17. COVER/DOOR/WIND.
18. EMERGENCY POWER
19. FIRST AID KIT

20. STANDARDS
21. RADIATION SOURCE
22. DOSEMETER
23. DOSE CALIBRATOR
24. D.C. SOURCE
25. D.C. METER, AVO
26. A.C. SOURCE
27. A.C. METER, AVO
28. PREC. PULSE GEN.
29. OTHER

30. NUCLEAR INSTRUMENTS
31. BIN, D.C. SUPPLY
32. PRE/LIN/LOG AMP.
33. SCALER/TIMER
34. SCA/DD
35. MCA
36. MCA. + COMPUTER
37. SAMPLE CHANGER
38. NIM/CAMAC MODUL
39. OTHER

40. RECORDERS
41. CHART, PEN/THERMO
42. XY PLOTTER
43. PRINTER/TELETYPE
44. PAPER TAPE PUNCH
45. MAGNETIC TAPE
46. VIDEO
47. PHOTOGRAPHIC
48. RM/T AND V
49. OTHER

50. ANALYTICAL INST.
51. PH METER
52. GAS CHROMATOGR.
53. LIQ. CHROMATOGR.
54. OXYGEN ANALYSER
55. HYDROGEN ANAL.
56. DIFF. THERMAL A.
57. SPECTROMETER
58. COLORIMETER
59. OTHER

60. REPAIR INSTR.
61. AVO METER
62. DIG. MULTI METER
63. OSCILLOSCOPE
64. FUNCTION GEN.
65. NUC. PULSE GEN.
66. ELECTRIC TOOLS
67. DIGITAL PROBES
68. N.V. TEST UNIT
69. OTHER

70. AUXILIARY EQUIP.
71. OVEN/HOT PLATE
72. DEWAR
73. CENTRIFUGE
74. REFRIGERATOR
75. VACUUM PUMP
76. COMPRESSOR
77. HOT WATER BATH
78. BALANCE
79. OTHER

80. NUCLEAR DETECTORS
81. ION CHAMBER
82. PROP. COUNTER
83. G.M. COUNTER
84. LIQ. SCINT. DET.
85. SOLID SCINT. DET.
86. GELI/SILI DET.
87. INTR. GE DET.
88. SURFACE BARRIER
89. OTHER

90. SPECIAL SYSTEM
91. REACTOR CONTROL
92. ACCELERATOR
93. COMPUTER
94. TELECOMM.
95. NUCL. IMAGING
96. NUC. MED.INSTR.
97. GEOPHYSICAL
98. PROCESS CONTROL
99. OTHER

HECS classification for hospital equipment needing regular inspection and preventive maintenance (I/PM)

Table 04—Procedure Codes

Procedure Text	Code	Interval I/PM Major	Interval I/PM Minor
Anesthesia Units	400	06	99
Anesthesia Unit Vaporizers	436	06	99
Apnea Monitors	420	06	99
Aspirators	433	12	06
Blood Pressure Monitors	434	06	99
Blood Warmers	445	12	06
Cardiac Resuscitators	421	06	99
Conductive Furniture	441	01*	99
Defibrillator/Monitors	408	06	03
Defibrillators	407	06	03
Duplex Receptacles	437	12**	99
Electric Beds	402	12	99***
ECG Monitors	409	12	06
Electrocardiographs	410	06	03
Electrosurgical Units	411	06	99
External Pacemakers	418	06	99
Fluid Delivery Systems	416	06	99
General Devices	438	06#	99#
Heart-Lung Bypass Units	430	03##	99
Heating Pads	412	06	03
Hemodialysis Units	413	06	03
Humidifiers and Nebulizers	431	06	99
Hypo/Hyperthermia Units	414	06	99
Infant Incubators	415	12###	06###
Intra-aortic Balloon Pumps	432	03##	99
Isolated Power Systems	439	12	06
Medical Gas/Vacuum Systems	440	99	12
Oxygen-Air Proportioners	444	06	99
Oxygen Analyzers	417	06	99
Pneumatic Tourniquets	443	06	99
Pressure Transducers	435	12	06
Pulmonary Resuscitators	422	06	99
Radiant Warmers	419	06	99
Sphygmomanometers	424	06	99
Temperature Monitors	425	12	06
Traction Units	427	12	06
Undefined	999	99	99

* Inspection of conductive furniture required in flammable anesthetizing locations only.

** NFPA 99 specifies six-month intervals for critical care areas. See Procedure/Checklist No. 437-484 in the Health Devices Inspection and Preventive Maintenance System for discussion.

*** Should be changed to a minor interval of six months on Equipment Records for beds dedicated to critical care areas.

\# These are typical inspection intervals for many devices. The intervals on the specific Equipment Record should be modified as appropriate.

Inspection interval may depend on usage. See the specific Procedure/Checklist in the Health Devices Inspection and Preventive Maintenance System and change interval on Equipment Record as needed

Intervals should be changed on Equipment Records for transport incubators to every six months for major I/PMs and every three months for minor I/PMs.

Equipment in use in Italian hospitals

Recently a large group of hospitals in northern Italy made an inventory of all medical equipment currently in use. This may be used as a check list when thinking about the problem of organising preventive maintenance and repair services.

The following listing was made by combining the inventories of all the hospitals and arranging the items in order of decreasing frequency. Thus, altogether there were 788 "monitors", 589 pumps, 478 electrocardiographs, and so on.

The hospitals in this group have a total of about 7000 beds.

Freq	Equipment
788	"monitor", all types
589	pump, all types
478	electrocardiograph
369	lamp, all types
354	pulmonary ventilator
259	microscope, lab
255	defibrillator
254	incubator
249	centrifuge
235	electronic scalpel
211	analyser (many types)
197	Xray tube assembly
180	anaesthesia set-up
158	blood dialyser
118	portable Xray set
110	operating table
108	Xray equip support
100	heat sealer
85	electrotherapy equip
78	U/S tomography
77	spectrophotometer
74	closed-circuit TV
59	image intensifier
	cardiostimulator
58	dentistry unit
	adjustable equip table
57	diathermy (microwave)
53	teleradiography unit
	autoclave
52	electroencephalograph
49	refrigerator (biological)
47	tomography table
45	stimulator (several types)
	TV attachment
44	microscope (operating)
	diathermy (shortwave)
43	Holter recorder

Freq	Equipment
42	balance, electronic
	audiometer
	ophthalmoscope
41	nebuliser
39	diathermy, U/S
	balance, mechanical
	centrifuge, refrigerated
38	phototherapy equip
37	pH meter
	blood freezer
34	centralised monitor unit
33	cycloergometer
	microtome
	coagulometer
30	spirometer
29	electrophoresis equip
	blood gas analyser
	polygraph
28	lab freezer
	drying oven
27	gamma counter
	blood warmer
	pressure gauge
26	videorecorder
	densitometer
	flame photometer
	colonscope
25	diathermocoagulator
24	gastroscope
	broncoscope
22	electromicrigraph
	ion generator
	dilution equipment
21	cystoscope
20	duodenoscope
	esophagus-scope
	dental Xray set
18	tomography system
	blood velocity meter
	angiograph
17	gas chromatograph
	cryostat
	cardiograph, ultrasonic
	gamma camera
16	cardiac ratemeter
14	cell separator
	fluoroscope
	therapy Xray set
13	cryosurgical set
	hypo/hyperthermy
	laser
	patient table

Freq	Equipment
12	distiller
	aerosol apparatus
	glassware washing machine
	water steriliser
	CAT scanner
11	mamograph
10	bilirubimeter
	dermotome, electric
	atomic absorption spectrometer
10	sample changer, automatic
	bone cutter
9	dosimeter
8	acoustic camera
	HPLC
7	endoscope
	fraction collector
	heat exchanger (blood)
6	calcimeter
	encephalograph, ultrasonic
	laparoscope
	homogeniser
	pneumatograph
5	chromatograph
	scanner, radioisotope
4	cobalt teletherapy unit
	ultracentrifuge
2	caesium teletherapy unit
	linear accelerator

- and many more minor items.