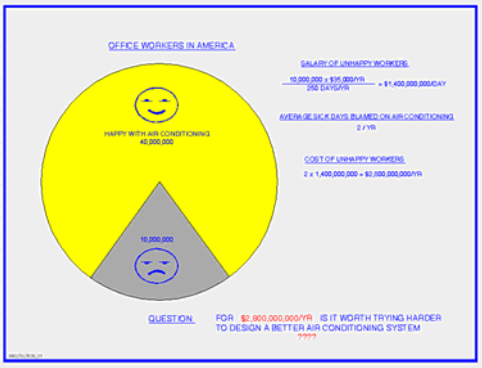
CASE STUDY

INDIVIDUAL TEMPERATURE CONTROL

TAMBLYN CONSULTING SERVICES
AUGUST 2003
TEL: 416-226-6565



BUILDING QUALITY REVIEW FOR PUBLIC WORKS CANADA BY DECIMA RESEARCH

IMPORTANT ISSUES (IN ORDER)

1. HVAC
2. LIFE SAFETY
3. CLEANING
4. ELEVATORS
5. SECURITY

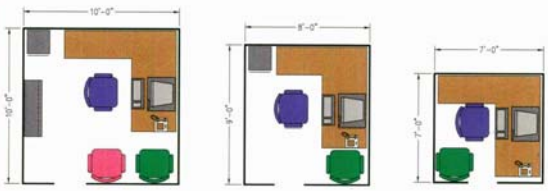
LOWEST SATISFACTION LEVELS

1. HVAC
2. TENANT NEWSLETTER
3. PARKING SECURITY
4. LUNCH ROOM SERVICE
5. LOBBY APPEARANCE
6. EMERGENCY PROCEDURE TRAINING

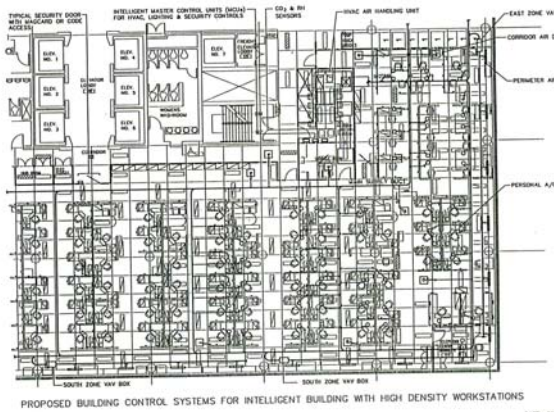
CAUSES OF DISSATISFACTION

1. LACK OF INDEPENDENT TEMPERATURE CONTROL
2. LACK OF AIR MOVEMENT CONTROL
3. LACK OF GOOD VENTILATION
4. CROWDING OF OFFICE SPACE

FORTHCOMING REDUCTION IN WORKSTATION SIZE



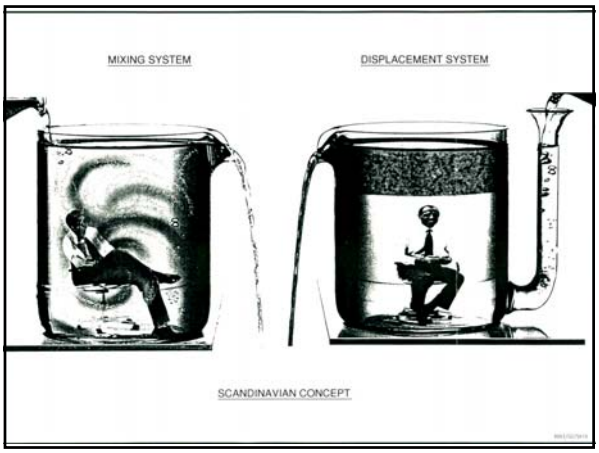
* SPACE RENTAL ASSUMED AT $20/FT²/YR

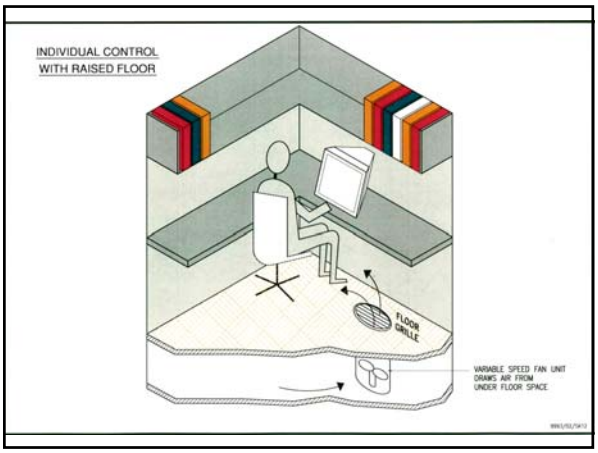


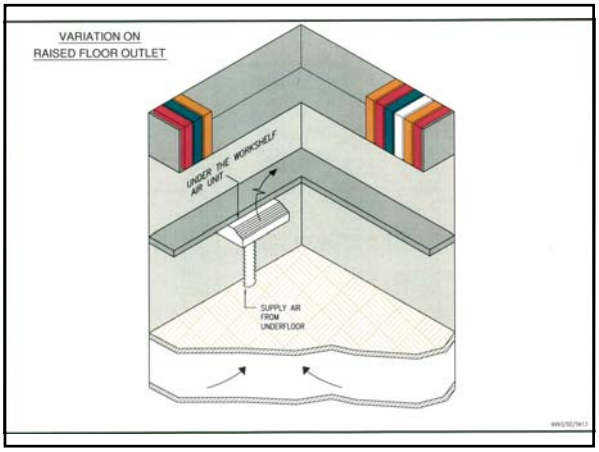
PROPOSED BUILDING CONTROL SYSTEMS FOR INTELLIGENT BUILDING WITH HIGH DENSITY WORKSTATIONS

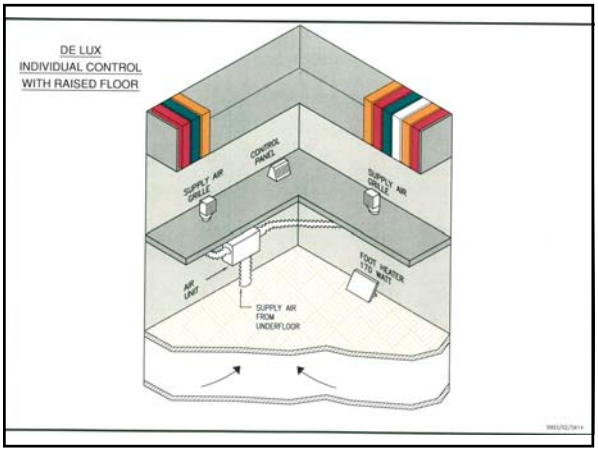
THE CASE FOR ZERO COMPLAINT IN AIR CONDITIONING SYSTEMS

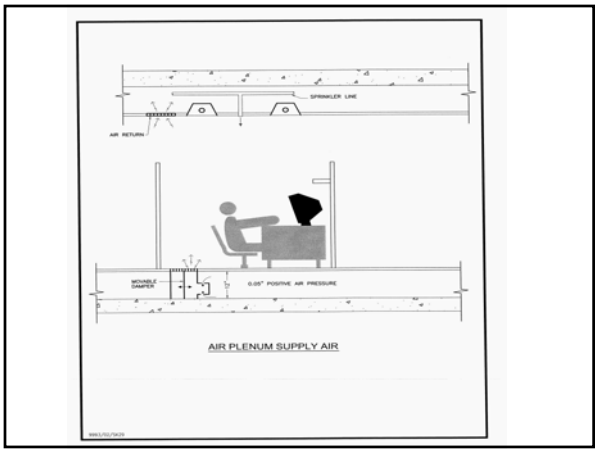
FEBRUARY 2003 TAMBLYN CONSULTING SERVICES

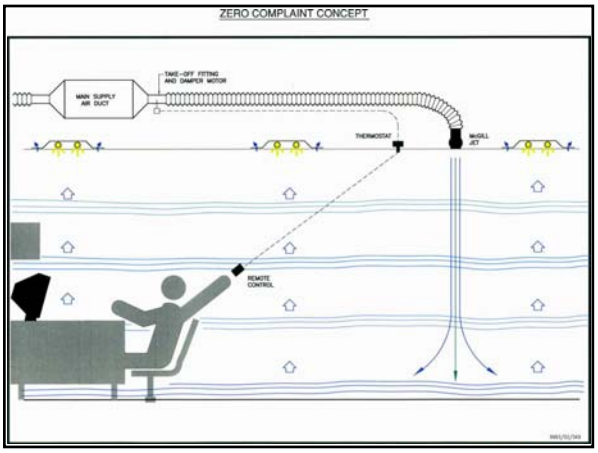

MIXING SYSTEM
DISPLACEMENT SYSTEM
SCANDINAVIAN CONCEPT

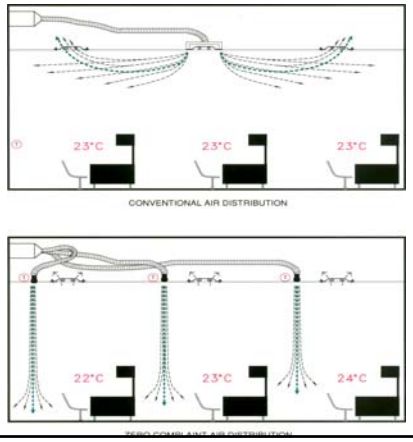

INDIVIDUAL CONTROL
WITH RAISED FLOOR
FLOOR GRILLE
VARIABLE SPEED FAN UNIT
DRAWS AIR FROM
UNDER FLOOR SPACE

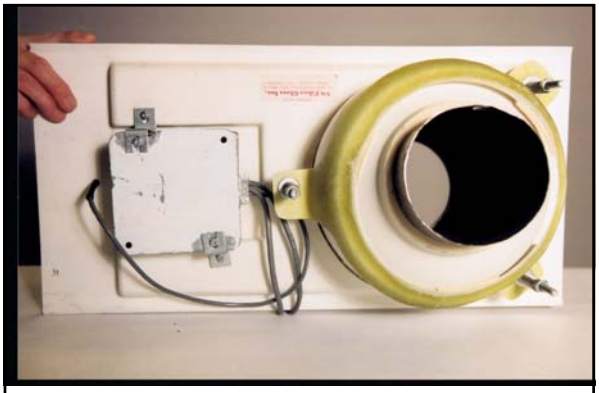

VARIATION ON
RAISED FLOOR OUTLET
UNDER THE WORKSHELF
AIR UNIT
SUPPLY AIR
FROM
UNDERFLOOR

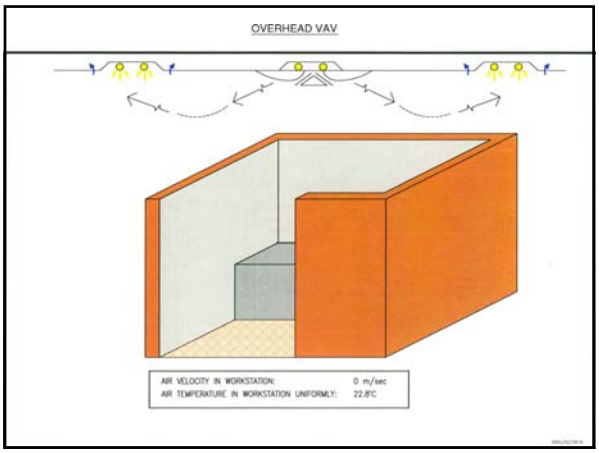

DE LUX
INDIVIDUAL CONTROL
WITH RAISED FLOOR
SUPPLY AIR
GRILLE
CONTROL
PANEL
SUPPLY AIR
GRILLE
FOOT HEATER
170 WATT
AIR
UNIT
SUPPLY AIR
FROM
UNDERFLOOR

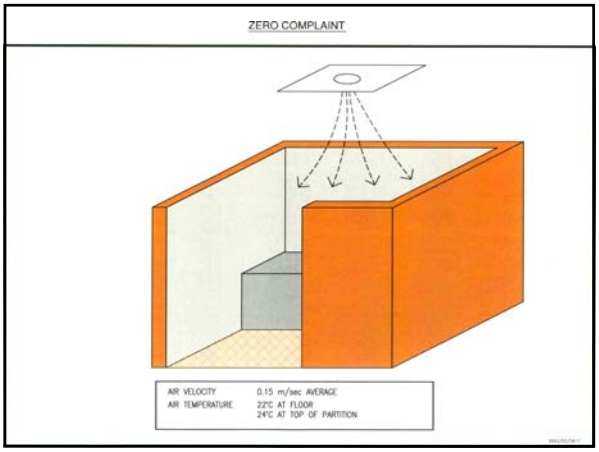

SPRINKLER LINE
AIR RETURN
MOVABLE
DAMPER
0.05" POSITIVE AIR PRESSURE
AIR PLENUM SUPPLY AIR

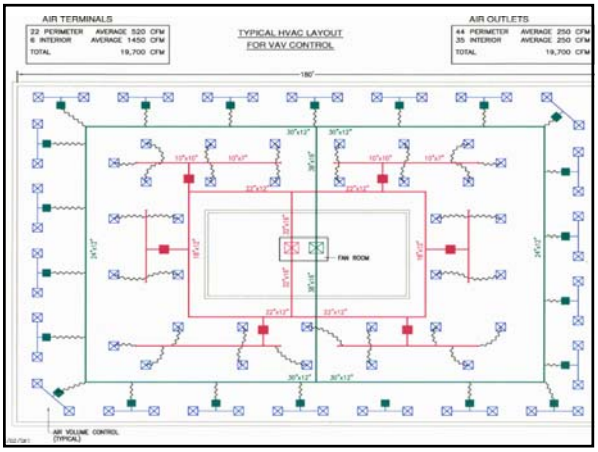

ZERO COMPLAINT CONCEPT
TAKE-OFF FITTING
AND DAMPER MOTOR
MAIN SUPPLY
AIR DUCT
THERMOSTAT
McGILL
JET
REMOTE
CONTROL

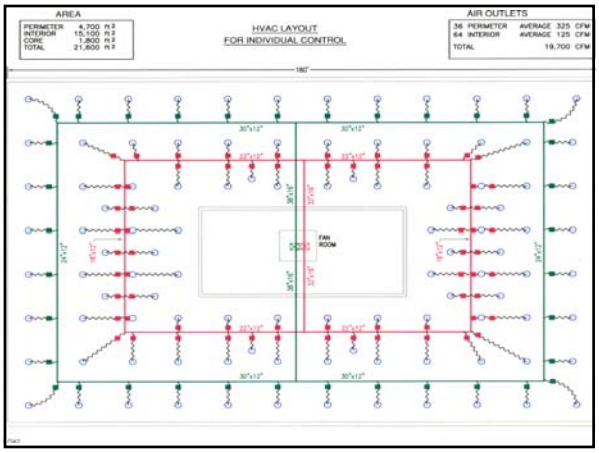

2.3°C
2.3°C
2.3°C
CONVENTIONAL AIR DISTRIBUTION
2.2°C
2.3°C
2.4°C

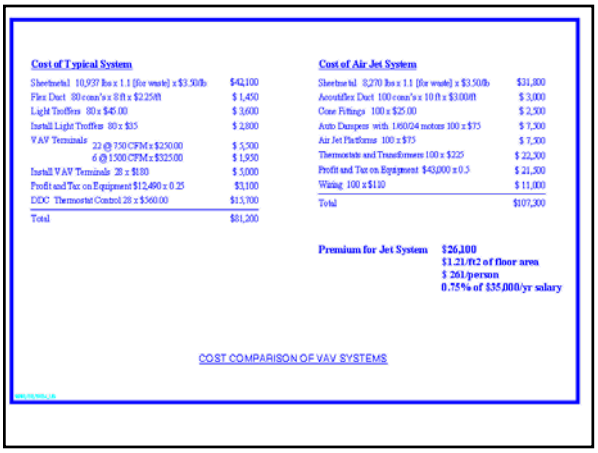












Cost of Typical System

Sheetmetal 10,937 lbs x 1.1 [for waste] x $3.50/lb	$42,100
Flex Duct 80 cons'x x 8 ft x $2.25/ft	$ 1,450
Light Troffers 80 x $40.00	$ 3,600
Install Light Troffers 80 x $35	$ 2,800
VAV Terminals 22 @ 750 CFM x $250.00	$ 5,500
6 @ 1500 CFM x $325.00	$ 1,950
Install VAV Terminals 28 x $180	$ 5,000
Profit and Tax on Equipment $12,490 x 0.25	$3,100
DDC Thermostat Control 28 x $560.00	$15,700
Total	$81,200

Cost of Air Jet System

Sheetmetal 8,270 lbs x 1.1 [for waste] x $3.50/lb	$31,800
Acoustiflex Duct 100 cons'x x 10 ft x $3.00/ft	$ 3,000
Cone Fittings 100 x $25.00	$ 2,500
Auto Dampers with 1460/24 motors 100 x $75	$ 7,500
Air Jet Platforms 100 x $75	$ 7,500
Thermostats and Transformers 100 x $225	$ 22,500
Profit and Tax on Equipment $43,000 x 0.5	$ 21,500
Wiring 100 x $110	$ 11,000
Total	$107,300

Premium for Jet System **$26,100**
$1.21/ft2 of floor area
$ 261/person
0.75% of $35,000/yr salary

COST COMPARISON OF VAV SYSTEMS

4900

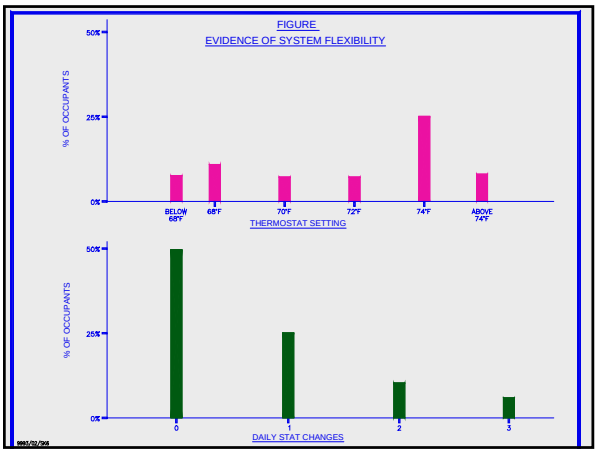
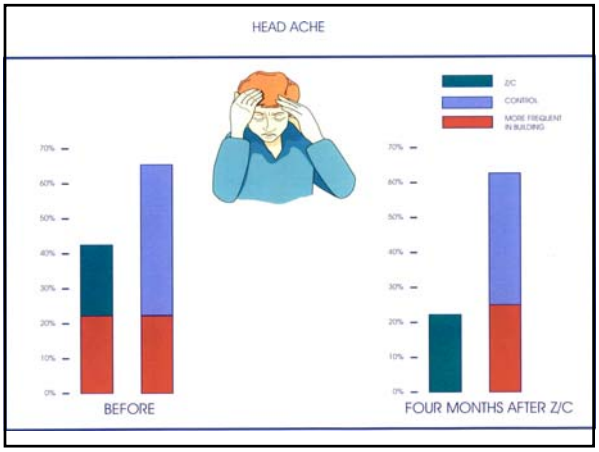
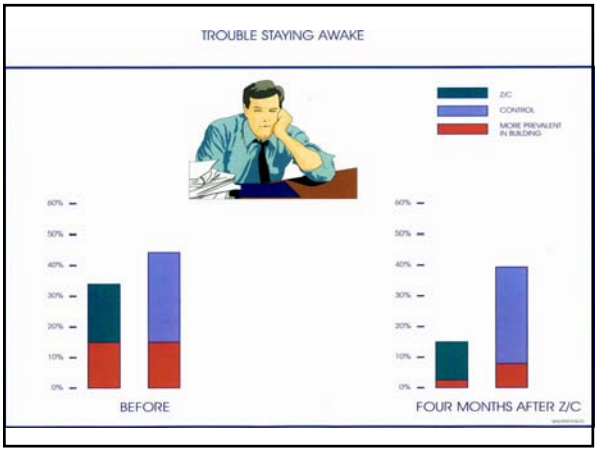
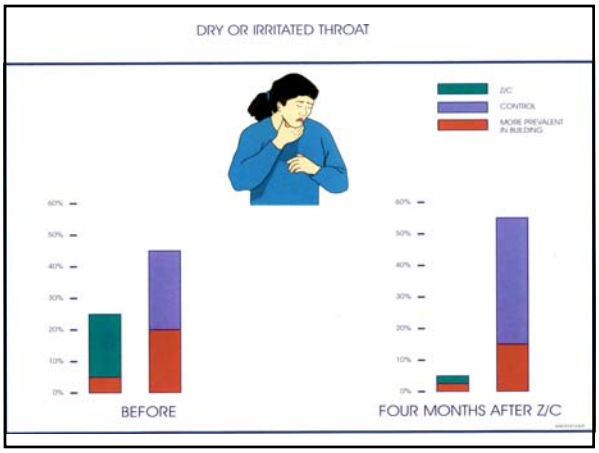


FIGURE
EVIDENCE OF SYSTEM FLEXIBILITY
% OF OCCUPANTS
50%
25%
0%
BELOW 68°F
68°F
70°F
72°F
74°F
ABOVE 74°F
THERMOSTAT SETTING
% OF OCCUPANTS
50%
25%
0%
0
1
2
3
DAILY STAT CHANGES


HEAD ACHE
Z/C
CONTROL
MORE FREQUENT IN BUILDING
70%
60%
50%
40%
30%
20%
10%
0%
BEFORE
FOUR MONTHS AFTER Z/C


TROUBLE STAYING AWAKE
Z/C
CONTROL
MORE PREVALENT IN BUILDING
60%
50%
40%
30%
20%
10%
0%
BEFORE
FOUR MONTHS AFTER Z/C


DRY OR IRRITATED THROAT
Z/C
CONTROL
MORE PREVALENT IN BUILDING
60%
50%
40%
30%
20%
10%
0%
BEFORE
FOUR MONTHS AFTER Z/C

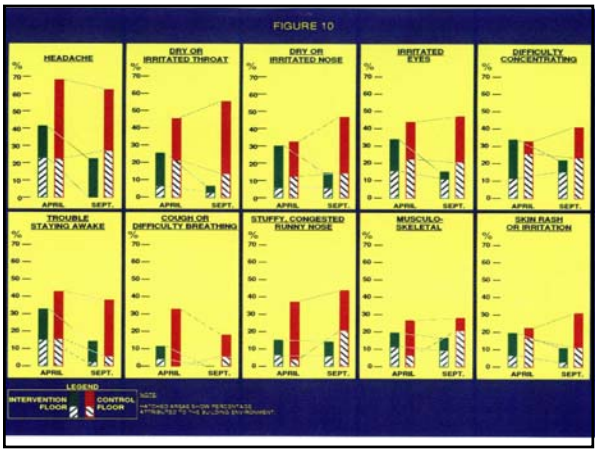


FIGURE 10
HEADACHE
DRY OR IRRITATED THROAT
DRY OR IRRITATED NOSE
IRRITATED EYES
DIFFICULTY CONCENTRATING
TROUBLE STAYING AWAKE
COUGH OR DIFFICULTY BREATHING
STUFFY, CONGESTED RUNNY NOSE
MUSCULO-SKELETAL
SKIN RASH OR IRRITATION
APRIL
SEPT.
LEGEND
INTERVENTION FLOOR
CONTROL FLOOR

FIGURE

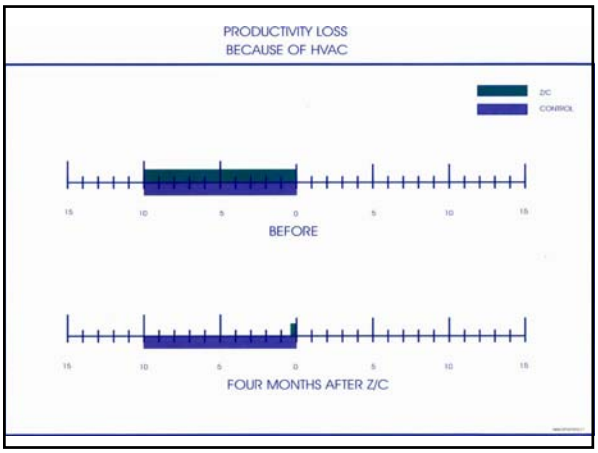
17. PLEASE RATE HOW MUCH CONTROL YOU HAVE OVER YOUR ENVIRONMENT: CIRCLE ONE

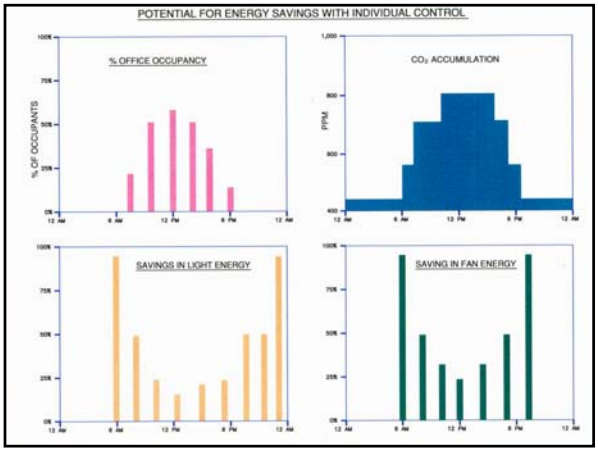
NO PERSONAL CONTROL — 0 1 2 3 4 5 6 7 — FULL PERSONAL CONTROL

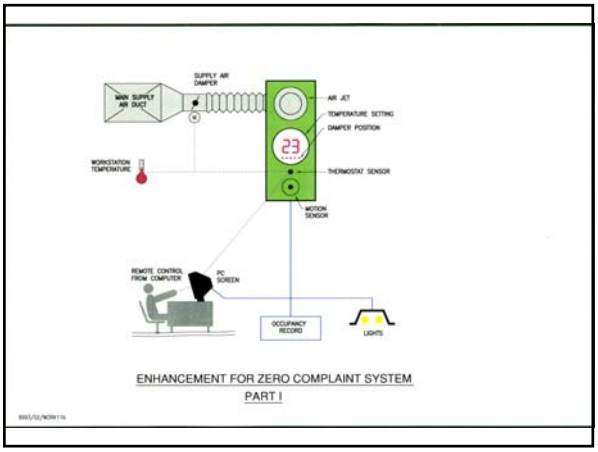
18. PLEASE RATE HOW MUCH YOU THINK THE HVAC CONDITIONS AT WORK INFLUENCE YOUR PRODUCTIVITY?

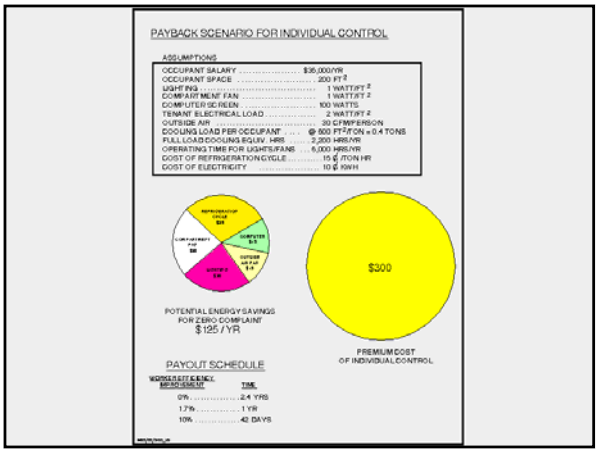
Decreased Productivity by — Increased Productivity by

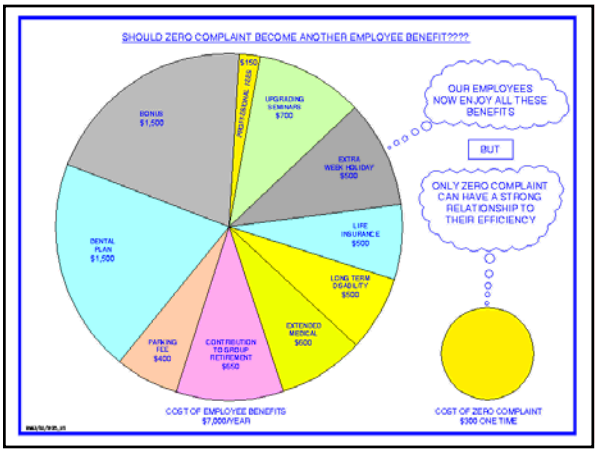
30% 20% 10% NO EFFECT 10% 20% 30%

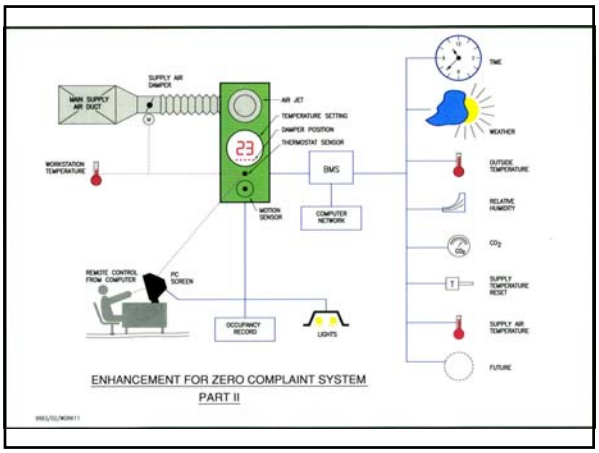


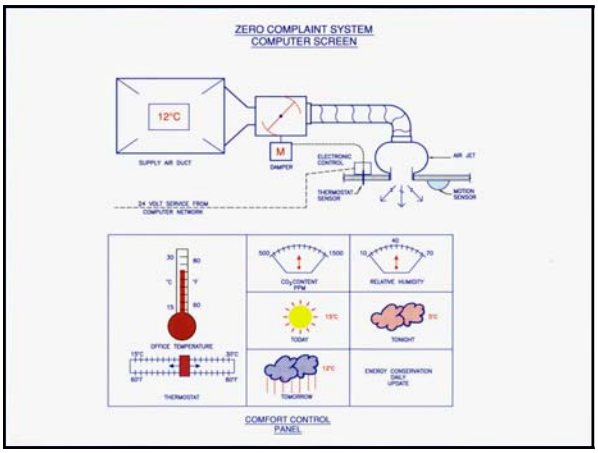









SUPPLY AIR DAMPER
MAIN SUPPLY AIR DUCT
AIR JET
TEMPERATURE SETTING
DAMPER POSITION
THERMOSTAT SENSOR
23
WORKSTATION TEMPERATURE
BMS
MOTION SENSOR
COMPUTER NETWORK
REMOTE CONTROL FROM COMPUTER
PC SCREEN
OCCUPANCY RECORD
LIGHTS
TIME
WEATHER
OUTSIDE TEMPERATURE
RELATIVE HUMIDITY
CO2
SUPPLY TEMPERATURE RESET
SUPPLY AIR TEMPERATURE
FUTURE
ENHANCEMENT FOR ZERO COMPLAINT SYSTEM
PART II


ZERO COMPLAINT SYSTEM
COMPUTER SCREEN
12°C
SUPPLY AIR DUCT
M
DAMPER
ELECTRONIC CONTROL
AIR JET
THERMOSTAT SENSOR
MOTION SENSOR
24 VOLT SERVICE FROM COMPUTER NETWORK
OFFICE TEMPERATURE
THERMOSTAT
CO2 CONTENT PPM
RELATIVE HUMIDITY
TODAY
TONIGHT
TOMORROW
ENERGY CONSERVATION DAILY UPDATE
COMFORT CONTROL PANEL