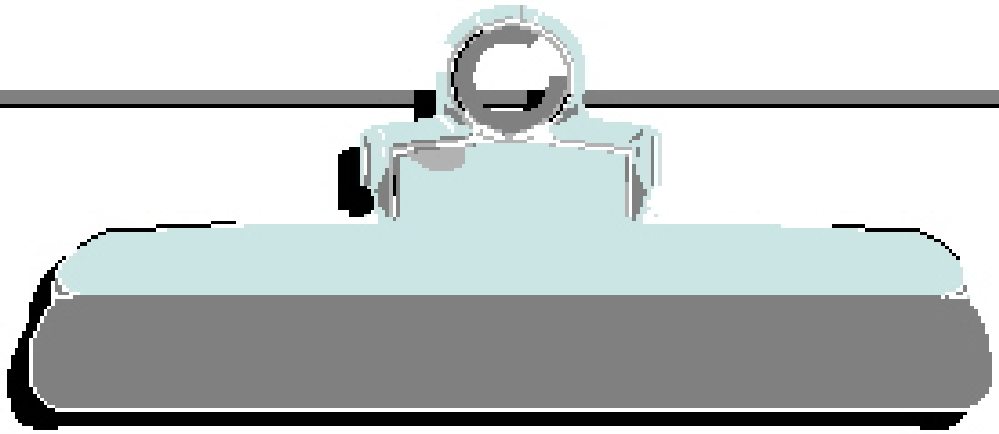


Ergonomics Principles

1. **PROCESS** – Promote effective work processes
2. **POSITION/SUPPORT** – Promote neutral body and limb position/support
3. **MOVEMENT** – Promote regular physical movement
4. **MATERIAL HANDLING** – Control manual material handling
5. **REACH** – Promote work in reach zone
6. **WORKSTATION/TOOLS/EQUIPMENT** – Provide correct workstation, tools and equipment
7. **TRAINING** – Provide competency based training
8. **ENVIRONMENT** – Control exposure to work environment
9. **HEALTH/WELLNESS** – Promote personal health and wellness
10. **FEEDBACK** – Provide on-going feedback for continuous improvement

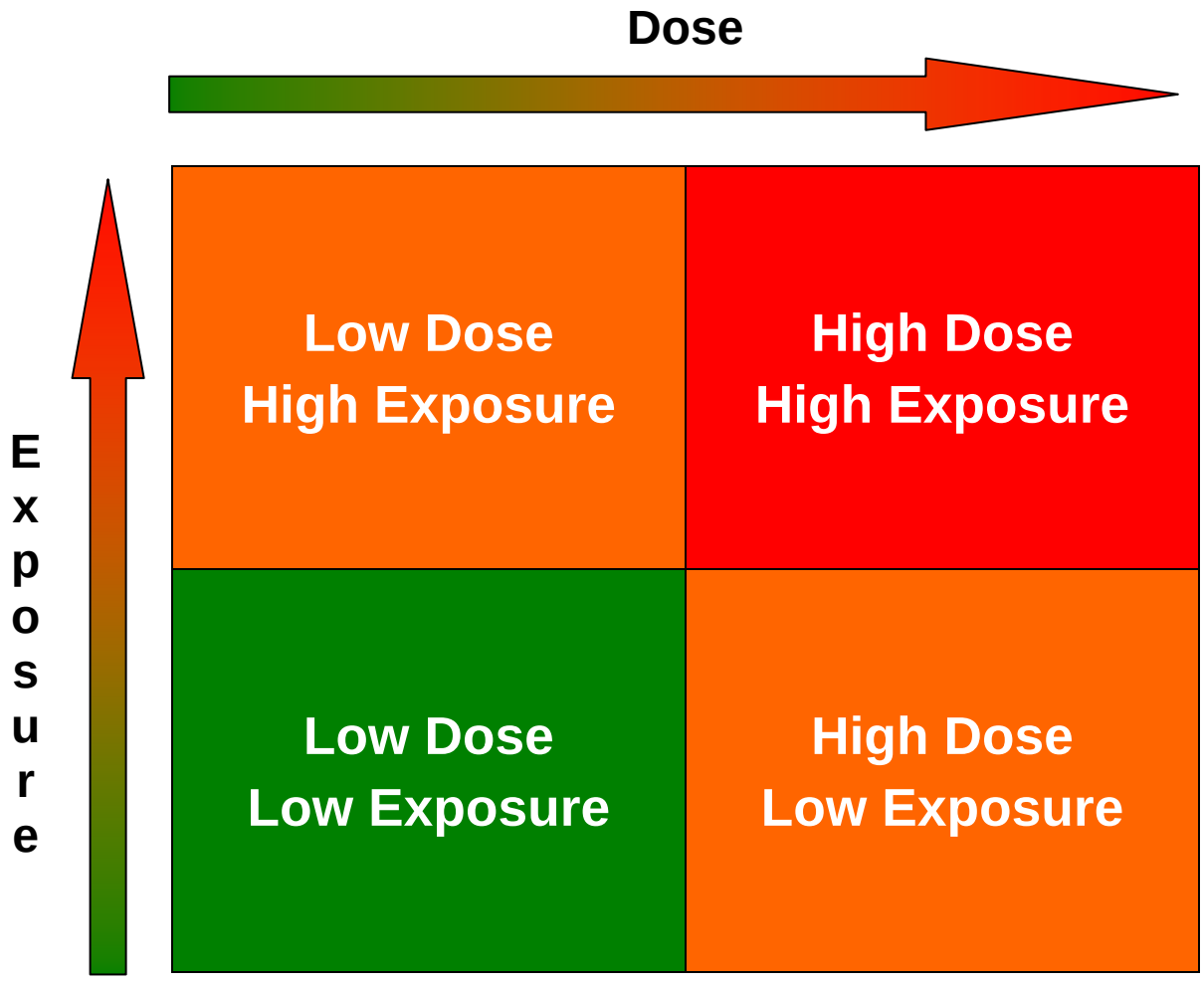
Risk Level Index

The key below establishes the **Risk Level Index** in terms of ergonomics issues (health, safety and productivity): **NOTE**: Ranking may be subject to change based on additional input.

- **LOW** considered **low** risk with low priority to change.
- **MOD** considered **moderate** risk, recommend modification as feasible.
- **HIGH** considered **high** risk, recommend concerted effort to modify.

Risk Level Index takes into account **Dose** (severity/stress level of the ergonomics risk factors) in combination with **Exposure** (duration/frequency of the ergonomics risk factors).

The higher the values for Dose and Exposure the greater the estimated risk for the activity.



ERGONOMICS ANALYSIS

Step 1 – PROVIDE BACKGROUND			
Job/Task:	**Date:**	**Time:**	**Analyzed by:**
Area/Dept/Location:	**Project Number:**		**Employee Name (optional):**
Lead/Supervisor:	**Workstation:**		**Job Title**:

Step 2 – CURRENT MAJOR STEPS	Step 3 – ERGONOMICS ISSUES	Risk	Step 4 –SOLUTIONS
1.		**Low** **Mod** **High**	
2.		**Low** **Mod** **High**	
3.		**Low** **Mod** **High**	
4.		**Low** **Mod** **High**	
5.		**Low** **Mod** **High**	

6.		**Low** **Mod** **High**	
7.		**Low** **Mod** **High**	
8.		**Low** **Mod** **High**	

MISC NOTES

Step 5 – FOLLOW-UP

ERGONOMICS ANALYSIS

Step 1 – PROVIDE BACKGROUND			
Job/Task: Fill CNC Reservoirs	**Date:** 2-16-08	**Time:** 11:00 AM	**Analyzed by:** Mark Johnson
Area/Dept/Location: Machine Center	**Project Number:** 00134		**Employee Name (optional):**
Lead/Supervisor: Lisa Jackson	**Workstation:** CNCs 1-7		**Job Title**: CNC Operator

Step 2 – CURRENT MAJOR STEPS	Step 3 – ERGONOMICS ISSUES	Risk	Step 4 –SOLUTIONS
1. Place empty 5 gallon buckets (2) on floor	None	Low	
2. Fill buckets 75% full with filler hose	Out-of-neutral posture (bend over) to handle hose to fill buckets **Goal:** Reposition buckets to allow neutral body position when filling buckets with hose	Mod	**OPTIONS**: 1. Plumb each CNC reservoir (cost factor) 2. Obtain cart to position buckets on the cart at a level to allow neutral body position (20" from the floor)
3. Pick up 2 buckets (one in each hand) by bucket handle and carry to CNC machine. Distance: 75 to 125 feet. Bucket weight: each at 30#	Ineffective work process Manual handling of heavy load (evident physical strain) **Goal:** reduce/eliminate significant physical strain	High	**OPTIONS**: 1. Plumb each CNC reservoir 2. Use long hose to reach to each CNC, will require up to 125' of hose 3. Obtain cart to transport buckets
4. At CNC machine set bucket down on floor Pick up one bucket and manually pour into CNC reservoir	Ineffective work process Manual handling of heavy load (evident physical strain) **Goal:** reduce/eliminate significant physical strain	High	**OPTIONS**: 1. Plumb each CNC reservoir 2. Use long hose 3. Obtain cart to maintain buckets in power lift zone and provide a base of support when tipping the bucket contents into the reservoir

5. Return empty buckets to storage area (located by the filler hose)		**Low**	

MISC NOTES

1. No injuries had occurred; however employees reported significant physical strain with the manual handling method
2. Seven (7) CNC machines are operated, depending on use each may be filled 1 to 3 times weekly. Approximately one bucket is used to fill the reservoir at each machine.

Step 5 – FOLLOW-UP

Based on overall review (including level of use, cost analysis to implement various solutions and employee input) **Option 3. Obtain cart** was implemented.

Cart is a Little Giant with two swivel and two fixed 8” wheels with handle on swivel wheel end. Cart platform height is 20”

Cart was purchased for $300.00; employees received training in use of the cart.

Follow-up at 1 and 3 months intervals indicated excellent employee acceptance with significant decrease in reported discomfort and decreased risk of injury.

Work Process Design Checklist

"YES" response indicates potential problem area that should receive further investigation.

Is the task complex?			
1. Does worker have to evaluate data before taking action?	YES	NO	NA
2. Must operator sense and respond to information signals occurring simultaneously from different machines without sufficient time to do so?	YES	NO	NA
3. Must operator process information at rate that might exceed capability?	YES	NO	NA
4. Is job so complex it takes a long time to train workers?	YES	NO	NA
5. Does task require a great deal of accuracy?	YES	NO	NA
6. Does work situation require monitoring several machines?	YES	NO	NA
Is the task monotonous?			
7. Does the worker repeat same task without change for entire shift?	YES	NO	NA
8. Does the worker lose track of task at hand because it is overly monotonous?	YES	NO	NA
Design and Use Standards			
9. Are controls standardized on similar equipment?	YES	NO	NA
10. Does design of any instrument increase reading errors? (Dials and instruments difficult to read quickly and accurately)	YES	NO	NA
11. Are controls difficult to reach and operate?	YES	NO	NA
12. When all readings are correct, do pointers in a group of dials point in different directions?	YES	NO	NA
13. Are dials grouped inconveniently?	YES	NO	NA
14. Is dial too complex for level of information required?	YES	NO	NA
15. Is it difficult to see immediately how a control is set?	YES	NO	NA
16. Does reading instruments require a lot of head or body movement?	YES	NO	NA
17. Does worker's hand obstruct dial when operating controls?	YES	NO	NA
18. Is there a need to tell difference between parts by touch?	YES	NO	NA
19. Is it difficult to recognize controls and tools by touch and/or position?	YES	NO	NA
20. Does the task require fine visual judgments? (Includes need to detect small defects, judging distances accurately)	YES	NO	NA
21. Are controls, instruments and equipment placed where they are difficult to see?	YES	NO	NA
22. Are warning lights located out of center of field of vision?	YES	NO	NA
Training (Technical and Safety)			
23. Is the workforce **inadequately** trained in the technical aspects of the job process and demands?	YES	NO	NA
24. Is the workforce **inadequately** trained in the safe performance of the job tasks?	YES	NO	NA
25. Is the workforce **inadequately** trained in methods (breaks, stretching, and warm-up activities) to control job fatigue	YES	NO	NA

OVER TO ADD COMMENTS

COMMENTS

Calculator for analyzing lifting operations

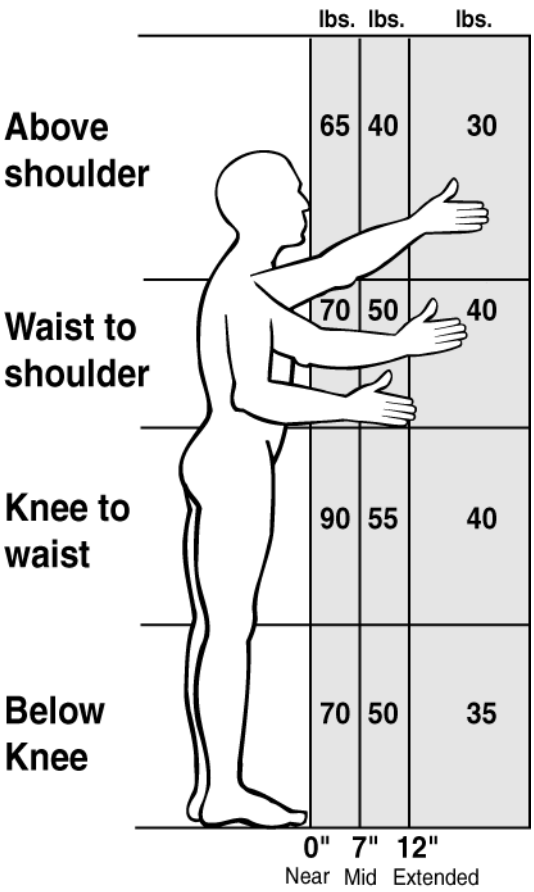
Company _____ **Evaluator** _____

Job _____ **Date** _____

1 **Enter the weight of the object lifted.**

Weight Lifted
lbs.

2 **Circle the number on a rectangle below that corresponds to the position of the person's hands when they begin to lift or lower the objects.**



3 **Circle the number that corresponds to the times the person lifts per minute and the total number of hours per day spent lifting.**

Note: For lifting done less than once every five minutes, use **1.0**

How many lifts per minute?	How many hours per day?		
	1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 min	1.0	0.95	0.85
1 lift every min	0.95	0.9	0.75
2-3 lifts every min	0.9	0.85	0.65
4-5 lifts every min	0.85	0.7	0.45
6-7 lifts every min	0.75	0.5	0.25
8-9 lifts every min	0.6	0.35	0.15
10+ lifts every min	0.3	0.2	0.0

4 **Circle 0.85 if the person twists more than 45 degrees while lifting.** 0.85

Otherwise circle 1.0

5 **Copy below the numbers you have circled in steps 2, 3, and 4.**

lbs.	X		X		=	Lifting Limit
Step 2		Step 3		Step 4		lbs.

6 **Is the Weight Lifted (1) less than the Lifting Limit (5)**

Yes – OK
No – HAZARD

Department of LABOR AND INDUSTRIES

Note: If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to:

1. Analyze the 2 worst case lifts—the heaviest object lifted and the lift done in the most awkward posture.
2. Analyze the most commonly performed lift. In Step 3, use the frequency and duration for all the lifting done in a typical workday.

As this lifting job is a hazard, you have several solution alternatives. For more ideas, go to the Ergonomics Ideas Bank:

www.lni.wa.gov/Safety/KeepSafe/ReduceHazards/ErgoBank/

- Reduce weight of load
- Increase weight of load so that it requires mechanical assist
- Reduce the capacity of the container
- Use slides, gravity chutes to eliminate lifting
- Use mechanical assist such as overhead hoist, manipulator, vacuum lift, pneumatic balancer, forklift
- Reduce the horizontal distance of the load away from the body by removing barriers, obstacles that make access to the object difficult; or by reducing the size of the container
- Team lift the object with two or more workers
- Improve layout of work process so the need to move materials is minimized
- Provide handholds which increase lifting capability up to 15%
- Rotate workers to jobs with light or no manual handling
- Use mobile storage racks to avoid unnecessary loading and unloading
- Redesign workstation layout to eliminate trunk twisting by locating objects within arm’s reach
- Design workstation with adjustable heights to eliminate bent forward posture when lifting
- Eliminate the use of deep shelves that require a worker to bend and reach for objects.
- Store objects at 30" off the floor
- Provide rigid containers to better control the load

For more solutions to material handling refer to these sites on the web:

Manual Material Handling Checklist

"NO" response indicates potential problem area that should receive further investigation.

1. Are the weights of loads to be lifted judged acceptable by the workforce?	YES	NO	NA
2. Are materials moved over minimum distances?	YES	NO	NA
3. Is the distance between the object load and the body minimized?	YES	NO	NA
4. Are walking surfaces:			
• Level?	YES	NO	NA
• Wide enough?	YES	NO	NA
• Clean and dry?	YES	NO	NA
5. Are objects:			
• Easy to grasp?	YES	NO	NA
• Stable?	YES	NO	NA
• Able to be held without slipping?	YES	NO	NA
6. Are there handholds on objects?	YES	NO	NA
7. When required, do gloves fit properly?	YES	NO	NA
8. Is the proper footwear worn?	YES	NO	NA
9. Is there enough room to maneuver?	YES	NO	NA
10. Are mechanical handling aids (powered or manual) used whenever possible?	YES	NO	NA
11. Are working surfaces adjustable to the best handling heights?	YES	NO	NA
12. Does material handling avoid:			
• Movements below knuckle height and above shoulder height?	YES	NO	NA
• Static muscle loading?	YES	NO	NA
• Sudden movements during handling?	YES	NO	NA
• Twisting at the waist?	YES	NO	NA
• Extended reaching?	YES	NO	NA
13. Is help available for heavy or awkward lifts?	YES	NO	NA
14. Are high rates of repetition avoided by:			
• Job rotation?	YES	NO	NA
• Self-pacing?	YES	NO	NA
• Sufficient pauses?	YES	NO	NA
15. Are pushing or pulling forces reduced or eliminated?	YES	NO	NA
16. Does the employee have an unobstructed view of handling the task?	YES	NO	NA
17. Is there a preventive maintenance program for equipment?	YES	NO	NA
18. Are workers trained in correct handling and lifting procedures?	YES	NO	NA

OVER TO ADD COMMENTS

COMMENTS

Workstation Checklist

"NO" response indicates potential problem areas that should receive further investigation.

1. Does the work space allow for full range of movement within the workstation?	YES	NO	NA
2. Is the height of the work surface adjustable?	YES	NO	NA
3. Can the work surface be tilted or angled to provide a comfortable view of the job being done?	YES	NO	NA
4. Is the workstation designed to reduce or eliminate:			
• Bending or twisting at the wrist?	YES	NO	NA
• Reaching above the shoulder?	YES	NO	NA
• Static muscle loading?	YES	NO	NA
• Full extension of the arms?	YES	NO	NA
• Raised elbows?	YES	NO	NA
5. Are the workers able to vary posture?	YES	NO	NA
6. Are the hands and arms free from sharp edges on work surfaces?	YES	NO	NA
7. Is an armrest provided where needed?	YES	NO	NA
8. Is a footrest provided where needed?	YES	NO	NA
9. Is the floor surface free of obstacles and flat?	YES	NO	NA
10. Are cushioned floor mats provided for employees required to stand for long periods?	YES	NO	NA
11. If a chair/stool is provided, is its design and adjustability satisfactory and suited to the task? (Back support, vertical adjustability, etc.)	YES	NO	NA
12. Are all task elements visible from comfortable positions (seated or standing)?	YES	NO	NA
13. Is there a preventive maintenance program for mechanical aids, tools, and other equipment?	YES	NO	NA
14. Is the worker able to work within the comfort and functional reach zones?	YES	NO	NA
15. Is it possible for the worker to alternate sitting and standing when performing the task?	YES	NO	NA
16. Is there adequate space at the workstation to perform the work effectively and comfortably?	YES	NO	NA
17. Can position of tools/equipment and controls be adjusted to suit the worker?	YES	NO	NA
18. If parts and materials containers/bins/tubs/carts are used, are they conveniently placed?	YES	NO	NA
19. Are mechanical aids and mechanical handling equipment available?	YES	NO	NA
20. Is the workstation accessible to material handling equipment?	YES	NO	NA
21. Is clearance space in the workplace adequate for maintenance tasks?	YES	NO	NA

OVER TO ADD COMMENTS

COMMENTS

Tool Checklist

"NO" response indicates potential problem areas that should receive further investigation.

1. Are power tools used and acceptable? *(If not acceptable what problems with power tools are noted?)*	YES	NO	NA
2. Are manual tools used and acceptable? *(If not acceptable what problems with power tools are noted?)*	YES	NO	NA
3. Are tools selected to limit or minimize:			
• Exposure to excessive vibration?	YES	NO	NA
• Use of excessive force?	YES	NO	NA
• Bending or twisting the wrist?	YES	NO	NA
• Finger pinch grip?	YES	NO	NA
• Problems associated with trigger finger?	YES	NO	NA
4. Are tools powered where necessary and feasible?	YES	NO	NA
5. Are tools evenly balanced?	YES	NO	NA
6. Are heavy tools suspended or counterbalanced in ways to facilitate use?	YES	NO	NA
7. Does the tool allow adequate visibility of the work?	YES	NO	NA
8. Does the tool grip/handle prevent slipping during use?	YES	NO	NA
9. Are tools equipped with handles of textured, non-conductive material?	YES	NO	NA
10. Are different handle sizes available to fit a wide range of hand sizes?	YES	NO	NA
11. Is the tool handle designed not to dig into the palm of the hand?	YES	NO	NA
12. Can the tool be used safely with gloves?	YES	NO	NA
13. Can the tool be used by either hand?	YES	NO	NA
14. Is there a preventive maintenance program to keep tools operating as designed?	YES	NO	NA
15. Have employees been trained:			
• In the proper use of tools?	YES	NO	NA
• When and how to report problems with tools?	YES	NO	NA
• In proper tool maintenance?	YES	NO	NA

OVER TO ADD COMMENTS

COMMENTS

Equipment Checklist

"YES" response indicates potential problem areas that should receive further investigation.

Foot/knee control pedals			
1. Does the operator have to operate foot/knee pedals while standing?	YES	NO	NA
2. To operate foot pedals or knee switches, must the worker assume an unnatural or uncomfortable posture?	YES	NO	NA
3. Are pedals too small to allow the operator to alter the position of the foot/knee?	YES	NO	NA
4. Are pedals triggered at a high repetition rate?	YES	NO	NA
Hand controls			
5. Hand controls placed to **not** allow neutral hand/arm/body position?	YES	NO	NA
6. Hand controls difficult (require excessive force) to operate?	YES	NO	NA
7. Hand controls not properly designed to take into account amount and types of force required for operation?	YES	NO	NA
8. Do workers have to exert high levels of power grip force to operate equipment?	YES	NO	NA
9. Do workers have to exert high levels of pinch grip force to operate equipment?	YES	NO	NA
Position - Sustained/Awkward			
10. To operate equipment, must worker maintain same body posture (either sitting or standing) all or most of the time?	YES	NO	NA
11. Is the pace of material handling determined by the equipment? (Feeding machines, conveyors, etc.)	YES	NO	NA
12. Does equipment operation require worker to repeat same movement pattern of arm/hand at a high rate of speed?	YES	NO	NA
13. Does equipment operation require continuous use (or nearly so) of both hands and both feet in order to operate controls or manipulate work object?	YES	NO	NA
Vibration - Whole body			
14. Is the body as a whole subjected to vibration from exposure to or operation of the equipment?	YES	NO	NA
Equipment Preventive Maintenance			
15. Is there **not** a regular maintenance schedule?	YES	NO	NA
16. Is the equipment designed or placed in such a way that cleaning and maintenance activities are **not** facilitated?	YES	NO	NA

OVER TO ADD COMMENTS

COMMENTS

Environment Checklist

"YES" response indicates potential problem areas that should receive further investigation.

Illumination			
1. Is special lighting necessary to perform the job?	YES	NO	NA
2. Is the general work area including egress/ingress poorly lit?	YES	NO	NA
3. Is lighting inadequate for the job tasks?	YES	NO	NA
4. Are controls, instruments and equipment poorly lit?	YES	NO	NA
5. Is the illumination not satisfactory for task?	YES	NO	NA
6. Is contrast poor between workspace and surroundings?	YES	NO	NA
7. Is workplace so poorly lit that there are great differences between brightness levels in panels, dials and surroundings?	YES	NO	NA
8. Is glare present in workplace? *(What is source of the glare?)*	YES	NO	NA
9. Is glare from displays a problem?	YES	NO	NA
Auditory			
10. Does the noise exposure require a hearing conversation program?	YES	NO	NA
11. Does noise level prevent or impair verbal communication?	YES	NO	NA
12. Are there auditory signals?	YES	NO	NA
13. Are some auditory signals hard to hear in general?	YES	NO	NA
Air ***(Temperature, Quality, Flow, Humidity)***			
14. Is the air temperature too cold?	YES	NO	NA
15. Is the air temperature too hot?	YES	NO	NA
16. Is it too humid in workplace?	YES	NO	NA
17. Are radiant heat sources placed near any workstations?	YES	NO	NA
18. Are there rapid changes in temperature in work environment?	YES	NO	NA
19. Is there so much air contaminant in the process that it settles on displays, making them difficult to see?	YES	NO	NA
20. Are suspended dust, mists and other particulates present in the air?	YES	NO	NA
21. Is air circulation too low?	YES	NO	NA
22. Is there too much air movement?	YES	NO	NA
23. Are workers exposed to rapid environmental changes?	YES	NO	NA
24. Is the humidity frequently uncomfortable enough to interfere with the job?	YES	NO	NA
25. Are there wet locations that may produce shock hazards for work with electrically powered equipment?	YES	NO	NA

OVER TO ADD COMMENTS

COMMENTS