

Physical Demands Subcommittee
Content Model and Classification Recommendations

APPENDIX B

Report of the
Physical Demands Subcommittee

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee
Content Model and Classification Recommendations

Physical Demands Subcommittee

Subcommittee Chair

Deborah E. Lechner, PT, MS

Subcommittee Members

Gunnar Andersson, MD, Ph.D.
Mary Barros-Bailey, Ph.D.
Sylvia E. Karman, Project Director
Occupational Information Development
Social Security Administration

September 1, 2009

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee
Content Model and Classification Recommendations

TABLE OF CONTENTS

Introduction	1
Methodology and Procedures	3
Physical Demands Subcommittee Recommendations.....	7
Definition of Terms.....	21
References	25
Appendix A	29

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Introduction

Purpose/Mission and the Role of Subcommittee: The purpose/mission of the Physical Demands Subcommittee is to provide recommendations to the OIDAP regarding the development of the physical demands content model and components of a new Occupational Information System (OIS). This new OIS will serve as a long-term replacement for the Dictionary of Occupational Titles (DOT), the Selected Characteristics of Occupations (SCO), and the Revised Handbook for Analyzing Jobs (RHAJ).

Each occupation in the new OIS will be described to some extent by the physical demands and requirements of the occupation. Our recommendations will focus on the following categories of physical demands:

- I. Manual Materials Handling/Strength;
- II. Postures and Positions;
- III. Mobility and Movement;
- IV. Psychomotor;
- V. Sensory; and,
- VI. Environmental.

Each of these categories will have a list of physical demands. For example, the Manual Materials Handling/Strength would have:

- Lifting;
- Carrying;
- Pushing; and,
- Pulling.

Many of these physical demands would have further qualifiers such as one-handed vs. two-handed lifting, carrying pushing and pulling, and would be rated according to duration and repetition.

The Physical Demands Subcommittee will also discuss the issues with the present “level of gross physical activity” (i.e., Sedentary, Light, Medium, etc.) that is consistent with an individual’s overall physical residual functional capacity (RFC). SSA needs such a schema at Steps Four and Five of their sequential disability determination process.

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Methodology and Procedures

The Physical Demands Subcommittee investigated and deliberated on the physical demands components of the OIS to inform its recommendations in the following manner:

Panel Meetings Involving Relevant Presentations: Members of the Physical Demands Subcommittee attended all meetings held by the Occupational Information Development Advisory Panel (Panel) on the following dates:

- February 23-25, 2009—Washington, DC
- April 27-29, 2009—Atlanta, GA
- June 9-11, 2009—Chicago, IL

During each of these Panel meetings, the Physical Demands Subcommittee heard testimony from a variety of stakeholders (within and outside the Social Security Administration (SSA)) regarding desired changes to the physical demands in the current DOT, SCO and RHAJ. The Chair of the Physical Demands Subcommittee presented a preliminary literature review at the June 2009 Panel meeting.

Formation of Subcommittees: The Physical Demands Subcommittee was formed on February 25, 2009 and consisted of Deborah Lechner, PT, MS, Chair; PhD, Gunnar Andersson, MD, PhD; Mary Barros-Bailey; and, Sylvia Karman, Project Director, Occupational Information Development, Social Security Administration.

Activities of Subcommittees: The Physical Demands Subcommittee met five times:

- April 2009—Panel meeting in Atlanta, GA
- Via teleconference—May 2009
- June 2009—Panel meeting in Chicago, IL
- Via teleconference—July 29, 2009
- Via teleconference—August 31, 2009

We have also exchanged information and research articles via email in preparation for our subcommittee meetings.

Studies: A preliminary feasibility study was conducted in June 2009, pulling data from Functional Capacity Evaluations (FCEs) that have been performed for the purpose of long term private disability determination. The purpose of this

Physical Demands Subcommittee

Content Model and Classification Recommendations

feasibility study is to determine the time required to perform a data transfer from existing .tif files into a Microsoft Excel spreadsheet which would permit the data to be analyzed. It was determined that sanitizing the records would involve five minutes per record. Entering data into a spreadsheet or database would take approximately 10 minutes per record. Over 900 records in which a comprehensive set of tasks was evaluated are available. Accessing these records would allow SSA to perform an exploratory factor analysis of physical demands and is being considered.

Sources Consulted: Members of the Physical Demands Subcommittee reviewed the physical components of existing general work taxonomies as well as taxonomies used in the ergonomics literature for the purposes of classifying the physical demands of work. See the bibliography and the Excel spreadsheet in Appendix A of this report for details.

DDS/ODAR/Appellate Council Visits: Members of the Physical Demands Subcommittee visited their local Disability Determination Services (DDS) offices and the Maryland Office of Disability Adjudication and Review (ODAR), and Appellate Councils to observe the current DOT/SCO taxonomy being utilized in SSA's disability determination process and the adjudication of appeals.

Review of Recommended Documents and SSA Working Papers: Members of the Physical Demands Subcommittee reviewed the following presentations and SSA-prepared and recommended papers;

- Working Paper: *What is a Content Model?*
- Working Paper: *Developing an Initial Classification System*
- Working Paper: *Social Security Administration's Legal, Program and Technical/Data Occupational Information Requirements*
- Working Paper: *SSA Plans and Methods for Developing a Content Model: Key Questions to Be Addressed*
- Presentation: A History of Job Analysis (Mark A. Wilson, Ph.D.)

In addition, the subcommittee reviewed user input from the following sources:

- A Call to Update the DOT: Findings of the International Association of Rehabilitation Professionals (IARP), Occupational Database Committee (Authors: Angela Heitzman et al), *The Rehab Professional*, 17(2)
- IARP OIDAP Survey Summary, July 2009, Final

Physical Demands Subcommittee

Content Model and Classification Recommendations

- Occupational Information System Survey Comments: IARP, August 3, 2009
- Comments from National Organization of Social Security Claimants' Representatives (NOSSCR)
- User Needs Analysis: Office of Disability Adjudication and Review; Office of Appellate Operations: (Authors: Roth & Dunn, SSA, OPDR).
- User Needs Analysis: Maryland Disability Determination Services (DDS) (Authors: Roth & Dunn, SSA, OPDR).
- National Association of Disability Representatives (NADR) OIDAP Committee – Collaborative Opinion: July 2009
- Comments from the American Board of Vocational Experts (ABVE)*
- Comments from the American Physical Therapy Association*
- Comments from the American Occupational Therapy Association*
- Presentation by Georgina B. Huskey, President, National Association of Disability Examiners
- Presentation by Trudy Lyon-Hart, Secretary of the National Council of Disability Determination Directors

**Included in Appendix F—Report of the User Needs and Relations Subcommittee*

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Physical Demands Subcommittee Recommendations

Issues Considered

In its deliberations, the Physical Demands Subcommittee considered the following:

- 1) The application of the physical demands taxonomy within the context of the Social Security Administration's Five-Step process for disability determination.
- 2) The efficacy or lack thereof of the current DOT/SCO physical demands classification system.
- 3) The effects of a change of the current DOT/SCO physical demands classification system on the medical and rehabilitation community that also currently utilizes the DOT for private disability determination and for workers' compensation cases, and the extent to which SSA and external users share requirements.
- 4) The input provided from stakeholders at the various Panel meetings from February through June of 2009.
- 5) The input provided from stakeholders in the 2002 job analysis research sponsored by the Department of Labor.

Specific Physical Elements (Demands)/ Recommended Level of Detail

In general, we feel that with the exception of a few areas, the current categories of physical demands provided in the DOT/SCO provide a fairly adequate level of detail. The physical demands that are not adequately covered are as follows:

- 1) Above v. below-waist lifting. There is currently no distinction between above and below-waist lifting. We consider this to be a problem when documenting the lifting requirements of various occupations and comparing those requirements to individuals with varying physical dysfunctions. For example, an individual who has sustained an upper extremity dysfunction could possibly handle 30 lb lifting below waist but only able to sustain 10 lb of lifting above waist. Conversely an individual with a lower extremity or back dysfunction would likely be able to lift much better above waist than below waist. Since there is such a high prevalence of applicants who apply for Social Security disability with a low back dysfunction/diagnosis, we believe that distinguishing between these two types of lifting is important for SSA.

Physical Demands Subcommittee

Content Model and Classification Recommendations

- 2) Reaching levels and types defined. The current DOT defines reaching as a physical demand of work. Claimants with shoulder dysfunction can tolerate reaching at shoulder height and below fairly well. However reaching above shoulder height is typically problematic. Claimants with hand injuries and resulting swelling in a dependent position, tolerate low reaching poorly. For these reasons, we recommend that reaching be subcategorized into three different heights a) Above shoulder; b) Shoulder to waist height; and, c) Below waist. In addition, the reaching required should be designated as either one-handed or two-handed reaching as noted below.
- 3) Addition of keyboarding and use of mouse/touchpad. Given the frequency of computer use in today's work environment, we feel that the addition of keyboarding and use of pointing devices is warranted. We feel that keyboarding involves a specialized type of finger dexterity that justifies identifying it as a separate physical demand. The use of the mouse requires reaching and handling. The use of the touchpad requires fingering and sensation.
- 4) Addition of forceful gripping and forceful pinching. The current DOT taxonomy addresses Handling and Fingering. Handling is described as hand function that includes contact of the palm of the hand with the object being handled. Fingering is described as contact of the fingers only (not palm of hand) with the object being handled. Neither of these descriptions address squeezing and pinching motions of the hands and fingers respectively. In SSA claimants with hand dysfunction resulting in weak or painful gripping and pinching this hand function is not appropriately addressed within the parameters of handling and fingering.
- 5) Documenting the uni- and bi-lateral requirements of occupations. Currently there are no classification options to address the requirements of one hand in manual materials handling and forceful exertions in the DOT/SCO. If an applicant with an injury or disease affecting one arm applies for disability, there currently is no way to compare the remaining residual functional capacity of his/her unaffected arm to the one-handed requirements of the job. By adding the following to the classification system, we feel that this issue could be addressed:
 - One-handed lifting
 - One-handed carrying
 - One-handed push and pull

Physical Demands Subcommittee

Content Model and Classification Recommendations

- One-handed reaching
 - One-handed fingering
 - One-handed handling
- 6) Addition of trunk (body) rotation/twisting/lateral bending. The current taxonomy in the DOT does not mention trunk/body rotation. For claimants who have low back dysfunction, trunk rotation is often a challenge and is required for many jobs. The trunk rotation can be repetitive or it can be statically held while a hand and positional task is performed.
- 7) Addition of neck rotation/twisting, bending and extension. The current DOT taxonomy does not address neck rotation and bending. For claimants with neck dysfunction (i.e., arthritis, cervical disc disease, and cervical stenosis) the extent of neck rotation and bending required for work is an important issue. The neck movements can occur repetitively or held statically while an eye-hand task is performed.
- 8) Addition of forward bending from sitting. The current DOT taxonomy addresses only forward bending from a standing position. However, some occupations require forward bending from a sitting position as well. Occupations such as mechanics, electricians, plumbers, painters are a few examples. Claimants with low back dysfunction may have difficulty with this position.
- 9) Increased specificity for climbing. Currently the DOT taxonomy addresses climbing. In the definition this can include climbing stairs, ladders, poles, ropes, or scaffolding. The physical ability required for each type of climbing is significantly different. Stair climbing is the least demanding of all types of climbing because it requires less hip and knee motion and strength. Ladder climbing requires significantly more hip and knee motion and strength and some use of the upper extremities. The physical demands of a vertical ladder are greater than an A-frame ladder. Pole and rope climbing requires similar hip and knee motion as ladder climbing but significantly more arm strength than ladder climbing. Stair climbing and climbing an A-frame ladder can typically be performed with one hand or arm. The other types of climbing require bilateral hand use. Climbing ramps may also need to be included.
- 10) Addition of Running. Not many professions require running. For those that require running, however, the demand is an important

Physical Demands Subcommittee

Content Model and Classification Recommendations

challenging occupational requirement. The current DOT does not address running as a physical requirement.

- 11) Categories for Balance. The current DOT has a single classification of balance. However, the balance required varies greatly depending on the surface on which the worker must work. For example, the balance required for walking on even surfaces is much less than that required for uneven surfaces. The balance required for ladder climbing, and beam and scaffold walking, is much greater than that for level walking. For these reasons, we recommend classifying balance into at least four categories: a) Even/Level surfaces; b) Uneven/Irregular surfaces; c) Ladder climbing; d) Beam and scaffold walking; and, e) Balancing by walking on an incline.
- 12) Separate Classification of Sitting, Standing, and Walking. The current DOT classifies sitting, standing, and walking as part of the General Physical Category. We recommend that each of these variables be classified separately and categorized according to duration or percent of day spent in these activities.
- 13) Ability to Alternate Position. There are some sedentary jobs where a sit-stand option is available. This identification borders on accommodation. However, if the sit-stand option is available, it opens up opportunities for employment that would otherwise be unavailable.
- 14) Ability to Use Assistive Devices: In some work environments the use of physical assistive devices is permitted and the work environment lends itself to the use of these devices. In other environments the use of assistive devices is not feasible. Notation of the occupations that allow these devices would be helpful.
- 15) Operation of Foot Controls: Needs to be added. Documentation of whether one or two feet are required would be helpful in cases where the applicant has use of only one foot such as the case if applicants with an amputation or with paralysis or loss of sensation of one foot.
- 16) Repetitive Twisting of Wrist: Needs to be added. Documentation of the presence of this activity in an occupation would be important to applicants with carpal tunnel, chronic tendonitis, and arthritis. Individuals with these diagnoses tolerate repetitive turning of the wrist and forearm poorly. These motions are present to some

Physical Demands Subcommittee

Content Model and Classification Recommendations

degree in many manufacturing jobs and in the food processing industry.

- 17) Handwriting. Needs to be added. Most occupations in today's environment required handwriting to some extent. The duration of writing can affect the work tolerance of those with carpal tunnel and arthritis.

Comprehensiveness: The Physical Demands Subcommittee believes that the physical demands taxonomy should be as comprehensive as possible, covering all physical demands that are required for work.

Specificity: The Physical Demands Subcommittee believes that the level of specificity or detail of the content model and taxonomy should be carefully balanced with practicality and feasibility in mind. Too little detail will result in the frustration that has occurred with the current DOT expressed by many of the user needs analyses and stakeholder presentations. Alternatively, too much detail will render the system impractical and cumbersome to use. We believe that the level of detail contained in many of the ergonomic taxonomies and assessment tools is more detail that would be feasible or practical for SSA. However, we believe that these tools can provide information that will be instructive for SSA in establishing certain parameters for operational definitions. For example, we recommend that SSA conduct a formal literature review of the topic of repetition to determine an appropriate operational definition for repetitive.

Operational Definitions: Operational definitions are extremely important to the reliability and validity of any data collection method for job analysis. The definitions must be written in sufficient detail to allow job analysts to correctly classify the physical demands. Our field experience in job analysis has shown that positions such as bending/stooping are difficult to classify correctly and to distinguish from standing or squatting/crouching without specific operational definitions. Questions arise such as: How much forward bending has to occur in order for the physical demand to be classified as stooping? Is it 10 degrees, 20 degrees, 30 degrees or more? Our experience indicates that it must be a visible angle that can be clearly distinguished. We have come to appreciate that there is no one magical number. However, an arbitrary cut point at least allows the analysts to be consistent with one another and with themselves on a re-test situation. The following provide a few examples:

- Trunk angle required to distinguish stooping from standing;
- Knee angle required to separate squatting from stooping;

Physical Demands Subcommittee

Content Model and Classification Recommendations

- Shoulder angle for reaching high, low, medium;
- Force for forceful gripping as distinct from handling; and,
- Number of consecutive steps to be considered walking vs. standing.

Recommended Rating System for Specific Demands

Significant controversy surrounds the issue of measurement parameters of the physical demands. However, most agree that some sort of classification system of the extent of repetition as well as duration should be included.

Repetition:

- Low Repetition: 1-12 times per hour
- Moderate: 13-30 times per hour
- High: 31 to 60 times per hour

While we agree that repetition should be addressed, we are not confident that this should be the classification system. It may be that the number of repetitions would vary depending on whether one is classifying upper extremity vs. trunk repetition. In our brief review of the ergonomics literature, we noted a wide variation in what is considered “repetitive.”

We feel that this subject deserves very close attention. As such we recommend a thorough analysis of the literature on repetitive work to determine the most appropriate classification system for repetition.

Duration: Several groups have mentioned that a scale for duration for physical demands is very important. However, most feel that the current categories of Never, Occasional (1-33% of the day), Frequent 34 – 66% of the day, and Constant > 66% of the day, are too broad. Most user needs groups and individuals requested a seldom or rarely category and IARP requested that the OIS classify jobs that require more than an 8-hour day. The length of time a physical demand is performed and the length of a workday should be captured in the data gathering process. Once the data is analyzed, future recommendations could address how best to address this issue.

Maximum Continuous Duration. In addition to the issue of total duration throughout the day, the maximum continuous duration a position is assumed or other physical demand must be performed is important as well. For example, a physical demand may occur occasionally (up to 1/3

Physical Demands Subcommittee

Content Model and Classification Recommendations

of the day) and in one occupation. The demand would be interspersed intermittently throughout the day while in another occupation, this 2.7 hours of activity would occur continuously. Many claimants can tolerate activity if the physical demand is required intermittently but may not be able to if it is required continuously for 2.7 hours.

Maximum Continuous Distance: For dynamic movements such as carrying, pushing, pulling, walking, climbing, running, crawling, etc., the maximum continuous distance can be a very important occupational demand. If a claimant can only walk 50 continuous feet and the occupation requires at least 500 feet of continuous walking, then there is an obvious mismatch between claimant's ability and the occupational demand. The challenge is that each job that is analyzed in an occupation may vary considerably when it comes to these distances based on the size of the physical location.

Variations of Physical Demands within Occupations: Each occupation will be studied by observing and measuring physical demands in multiple representative jobs. Most certainly there will be a range of demands for each occupation. Even if demands are similar, the extent to which these demands are required will vary. The occupational classification will identify the highest physical demand level in individual job analyses that will then be used to determine a mean for each occupation.

General Physical Category

The current DOT taxonomy defines general physical demands categories as Sedentary, Light, Medium, Heavy, Very Heavy. Some frustrations with these general physical categories of have been expressed by user groups. The frustrations have mainly centered on several issues:

- 1) Some of the categories are too broad. For example, the Medium category contains occupations that require 21-50 lbs of lifting and Heavy includes materials handling in the 51-100 lbs.
- 2) The definitions include the extent of sitting, standing, and walking that are required for each level of work. The specific duration of sitting, standing and walking are only vaguely defined for the Sedentary and Light levels and not defined at all for Medium level and above.
- 3) Interpretation of the levels vary from organization to organization and among vocational evaluators, insurance companies and case managers, making it difficult to report functional testing results in a way that is consistent and meaningful for all referral sources.

Physical Demands Subcommittee

Content Model and Classification Recommendations

- 4) Classification of jobs with multiple levels of material handling.

Recommendations for improvements include:

- 1) More narrow ranges of material handling.
- 2) Focus definitions on materials handling only. Classify sitting, standing and walking as independent physical demands and rate according to the duration.
- 3) Standardization of interpretation of the categories and how they relate to claimant disability or ability is needed in the new OIS. Once data is captured, recommendations should focus on suggesting methods to represent this concept. That is, these could involve assigning ranges to weights that are standardized.
- 4) Occupations should be classified according to the heaviest level of material handling required. So that if a job requires lifting of a variety of materials some of which weigh 10 lb, some 35 lb and some 53 lb. Then the job would be classified based on the 53 lb weight. If a job had light lifting but heavier pulling, the job would be classified according to the pulling.

Recommendation:

- 1) Create more categories that are not as broad. Perhaps a system that increases by smaller weight increments may provide a solution. However, once the data is gathered and analyzed, future recommendations could suggest a scale that is more applicable than what users presently have.

Recommend Methods of Data Collection

For the DOT, data was collected using field analysts. However, this data collection has been criticized for lack of standardization. In fact, standardization was provided through the *Handbook of Analyzing Jobs*. But the training and utilization of this method was not consistent across all field locations. For the O*NET, the data collection was entirely through self report. The Physical Demands Subcommittee strongly believes that data collection for the physical demands of work cannot be done via self-report. There are numerous studies that demonstrate that self-reported physical demands are neither reliable nor valid, especially at the level of detail requested by user needs analyses, and stakeholder comments (Wiktorin, Kariqvist, & Winkel, 1993; Oliveira de Souza & Gil Coury, 2004).

Physical Demands Subcommittee

Content Model and Classification Recommendations

Sensory/Motor Category

This category includes feeling, hearing, vision, and tasting/smelling. The American Occupational Therapy Association identified sensory skill demands as “actions or behaviors required to locate, identify, and respond to sensations and to select, interpret, associate, organize, and remember sensory events based on discriminating experiences through a variety of sensations that include visual, auditory, proprioceptive, tactile, olfactory, gustatory, and vestibular.” Analysis of the literature regarding such topics as visual ergonomics, hearing demands of work, and other related areas found little contemporary research regarding the sensory demands of work.

User groups comments are summarized in the following sensory categories:

- 1) Speech: Talking may be a function of the mental/cognitive process of receptive and expressive speech as is addressed in that subcommittee’s recommendations with respect to the outcomes of expressive and receptive language that are measurable and observable. From a physical standpoint, only speech quality (sound and frequency) are considered.
- 2) Feeling:
 - a. User Recommendation: Tactile perceptions of objects, environmental conditions, and other sensations felt through the skin.
 - b. Measurement needs: refined frequency measures.
- 3) Vision:
 - a. User Recommendation: Degree of vision needed to complete the task (i.e., peripheral, accommodation, near acuity, far acuity, etc.), including vision in one or both eyes.
 - b. Measurement needs: level of peripheral vision required to avoid hazards and distance from visual stimuli represented the greatest need for data elements to be included the content model. Scales should use realistic units (e.g., distances), such as the use of the Snellen chart, of measurement rather than frequencies.

Physical Demands Subcommittee

Content Model and Classification Recommendations

- 4) Hearing:
 - a. User Recommendation: Degree of sound discrimination to safely and adequately carry out a work activity. Specificity in job requirements with respect to distinguishing different levels of sound as well as any level of sound regardless of source.
 - b. Measurement needs: Decibel and frequency demand scales rather than frequency scales.
- 5) Tasting/Smelling:
 - a. The ability to detect the existence of pleasant or unpleasant tastes or smells may be essential to certain occupations, such as first responders (e.g., firefighter, police officer) and those in the hospitality industry (e.g., chef, waitress, child care provider). It should be included when their impairment alone, or in constellation with other impairments, may preclude a claimant from performing the core functions of occupations for which they may have skills.

Recommendations

- 1) Defining talking within the physical demands context in terms of speech quality rather than the receptive or expressive qualities that are more of the mental/cognitive process.
- 2) Consider more discrete, appropriate, and functional levels of measurement for feeling, vision, and hearing.
- 3) Although not frequently encountered as an impairment consideration, including taste and smell sensory demands due to their relevance as essential and core functions of a variety of occupations.
- 4) Sensory demands are not a primary expertise of any of the members of the Physical Demands Subcommittee. For this reason, we recommend that SSA convene a focus group or roundtable of experts in the area of vision and hearing for more specific recommendations and definitions that are contemporary.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Legal, Technical, and Data Issues

Legal issues in the physical demands area that are important to consider relate mainly to the accuracy of the data that populates the occupational data base. The data collection method must be shown to be reliable and valid. The data should be collected by direct observation using a classification system with well-defined operational definitions rather than self-report.

Test-retest and inter-rater reliability should be studied. Validity will be more difficult and costly to establish. We believe that the data collection method could be compared to a full-day time and motion study in a limited number of occupations at each of the physical demand levels (Sedentary, Light, Medium, etc). A less rigorous but alternative method of establishing validity would be to compare the results of the data analysis method to expert opinion. However, this method of face validity is the weakest form of validity.

A training course and accompanying manual would need to be developed. Analysts would need to attend a rigorous training with testing and certification in the established data collection method. Based on research conducted in 2002 with the US Department of Labor, the training could occur via the internet with protocol practice using videotaped jobs. Periodic re-certification would be required.

Suggested Studies

The Physical Demands Subcommittee recommends that SSA undertake the following studies to inform the overall process:

- Perform an analysis of the literature on repetition to determine the most appropriate definition of the term repetitive.
- Perform contemporary research regarding the sensory demands of work, particularly as these relate vision and hearing, the areas most identified by users that require attention.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Environmental Category

A complete job description should include information about the environmental conditions present. Of particular concern are exposures to heat and cold, humidity, wetness (moisture, rain, water), dust, chemicals, fumes, gases, smoke, mold or mildew, fibers including asbestos, vibration and general conditions of the workplace (hazardous environment, heights, noise, animals, etc.). Whether work is performed outdoors or indoors is important since environmental factors are more difficult to control outdoors.

Most research on the effect of environmental factors on health and human performance concerns noise, thermal stress (heat and cold), and vibration. In areas such as noise and vibration safety standards have been developed which include level and time of exposure. This is also true for exposure to fibers (such as asbestos). With respect to thermal stress the best measure would be the core temperature (about 98.6° F or 37° C), but this is an uncomfortable measure to obtain. In thermally neutral environments (air temperature 20-23° C for a resting, comfortably clothed person) the body maintains its heat balance by regulation of blood flow. When the temperature increases beyond that level or when vigorous activity is performed increased blood flow in the skin results in sweating. Under excessive heat stress this mechanism shuts down and the core temperature rises (hyperthermia) with potential development of heat exhaustion and even heat stroke. Conversely, in colder temperatures the body restricts this blood flow, then contracts muscles rapidly (shivering). With extreme cold the regulation fails and the body starts losing heat to the environment (hypothermia). This can cause death. A complicating factor is the heat accommodation that naturally occurs in a hot environment. This process results in increase of sweating, reduced salt concentration in sweat and reduction in core temperature and heart rate. To determine heat stress one needs to measure air temperature, humidity, air velocity and surrounding surface temperatures. Although a number of measures have been developed to address these interactions the “dry bulb temperature” thermometer is the simplest and most practical (Hancock & Vasmatazidis, 1999).

In 1986 NIOSH developed a set of heat stress criteria as requested by OSHA (Millar 1986). Those are primarily based on effective temperature (which combines air temperature, humidity and air movement) and exposure time. A formula has also been developed to convert temperature to “wet bulb globe temperature” (WBGT) which takes radiant heat and air velocity into account (Yagloglou & Minard, 1957). Recommended exposure limit curves were developed by NIOSH taking the environmental heat (WBGT) and metabolic heat (generated by the worker) into account (NIOSH Publications 86-113). The simplest way to describe heat stress is to record the temperature, time of exposure, and frequency of exposure.

Physical Demands Subcommittee

Content Model and Classification Recommendations

As exemplified in the discussion of heat stress, highly sophisticated analyses can be performed for most environmental conditions. In the context of a useful job description, all the discussed exposures should be described, but detailed measurements of exposures are unpractical. At a minimum the exposure, its concentration (severity), frequency and the workers ability to address the exposures (protective equipment, etc.) should be described.

Recommendations:

- 1) Describe and define environmental conditions as they relate to: heat and cold, humidity, wetness (moisture, rain, water), dust, chemicals, fumes, gases, smoke, mold or mildew, fibers including asbestos, vibration and general conditions of the workplace (hazardous environment, heights, noise, animals, etc.).
- 2) Define appropriate measures for each condition where possible (e.g., for noise and vibration issues provide details of the level and time of exposure) or, at a minimum, include descriptions of levels of exposure, concentration or severity, frequency and accommodations available to address the effects of the exposure (such as protective equipment).

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Definition of Terms

Accommodation: adjustment of lens of eyes to bring an object into sharp focus.

Balancing: maintaining body equilibrium to prevent falling.

- Balancing on level surfaces
- Balancing on Uneven surfaces
- Balancing on Ladders
- Balancing on Beam and Scaffolding

Carrying: Transporting an object over a distance through walking, usually holding the load in the hands or arms.

- One-handed: using one hand or arm to carry the object
- Two-handed: using both hands or arms to carry the object

Color Vision: ability to identify and distinguish colors.

Crawling: moving about on hands and knees, hands and feet or on the abdomen

Crouching: bending the body downward and forward by bending legs at the hips and knees with simultaneous forward bending of the spine. This is typically performed when working with material that is at or near the floor level. Squatting includes positions where one knee is on the floor or both knees are off the floor.

Depth Perception: ability to judge distances and spatial relations.

Far Acuity: clarity of vision at 20 feet or more.

Feeling: perceiving attributes of items as size, shape, temperature as experienced through the skin.

Field of Vision: Observing an area that can be seen up and down and right and left when eyes are fixed on a given point.

Fingering: picking, pinching, or otherwise working primarily with the fingers. The object handled does not contact the palm of the hand.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Handling: seizing, holding, grasping, turning, or working with hands; using the hands in such a fashion that the object being handled contacts the palm and fingers of the hand.

Hearing: perceiving the nature of sounds by the ear.

Kneeling: bending the legs at the knees to come to rest on both knees.

Ladder Climbing: Ascending or descending either A-frame or vertical ladders.

Lifting: Raising or lowering an object from one level to another. Involves primarily vertical displacement of the load but can also include a component of horizontal displacement as well. Can involve one or two-handed lifting and can occur either above waist or below waist.

- One-handed: using one hand or arm to raise or lower the object
- Two-handed: using both hands or arms to raise or lower the object
- Above-waist: lifting that occurs from the waist and above. Typically performed primarily with the strength of the arms, shoulders, and upper back.
- Below-waist: lifting that occurs from the floor to approximately waist height. Typically performed primarily with the strength of the legs and low back.

Near Acuity: clarity of vision at 20 inches or less.

Physical Demands: occupational demands that require movement of the body, including arms, legs, hands, feet, neck and back.

Pulling: Exerting force upon an object so that the object moves toward the force.

- One-handed: using one hand or arm to pull the object
- Two-handed: using both hands or arms to pull the object

Pushing: Exerting force upon an object so that the object moves away from the force.

- One-handed: using one hand or arm to push the object
- Two-handed: using both hands or arms to push the object

Physical Demands Subcommittee

Content Model and Classification Recommendations

Reaching: extending arms and hands away from the body in any direction. Shoulder angle must be 45 degrees from the body to be considered reaching.

Three levels of reaching include:

- Low: below the waist
- Medium: waist to shoulder height
- High: above shoulder

Scaffolding or Pole Climbing: Ascending or descending scaffolding or poles.

Sitting: Remaining in a seated position with knees and hips flexed to some extent and buttocks resting on surface.

Speech: voice tone, quality, projection, and other physical attributes during speech production in the communication process.

Stair Climbing: Ascending or descending stairs.

Standing: Remaining on one's feet in an upright position without walking.

Strength Category: The manual material handling/ demands category of the work.

Stooping/Forward Bending: bending the body downward and forward from a standing position by bending the spine at the hips and/or waist. The hips must be flexed more than 20 degrees and the knees are kept relatively straight (flexed no more than 35 degrees).

Tasting/Smelling: distinguishing flavors or odors using the tongue and/or nose.

Walking: Moving about on foot. Requires three consecutive steps to be considered walking.

- Level surfaces: surfaces that are level and do not include ramps or uneven terrain
- Uneven surfaces: surfaces that include uneven terrain. Includes walking outside over grass, dirt, gravel, up and down curbs
- Ramps/inclines: surfaces that include an incline of over 15 degrees

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee

Content Model and Classification Recommendations

References

- Breen, R., Pyper, S., Rusk, Y., & Dockrell, S. (2007). An investigation of children's posture and discomfort during computer use, *Ergonomics*, *50*, 1582-1592.
- Bruijn, I., Engels, J. A., & Gulden, J. W. J. (1998). A simple method to evaluate the reliability of OWAS observations, *Applied Ergonomics*, *29*, 281-283.
- Buchholz, B., Paquet, V., Punnett, L., Lee, D., & Moir, S. (1996). PATH: A work sampling-based approach to ergonomic job analysis for construction and other non-repetitive work, *Applied Ergonomics*, *27*, 177-187.
- Buchholz, B., Paquet, V., Wellman, H., & Forde, M. (2003). Quantification of Ergonomic Hazards for Ironworkers Performing Concrete Reinforcement Tasks During Heavy Highway Construction, *AIHA Journal*, *64*, 243-250.
- Chung, M. K., Lee, I., & Kee, D. (2003). Assessment of postural load for lower limb postures based on perceived discomfort, *International Journal of Industrial Ergonomics*, *31*, 17-32.
- Chung, M. K., Lee, I., & Kee, D. (2005). Quantitative postural load assessment for whole body manual tasks based on perceived discomfort, *Ergonomics*, *48*, 492-505.
- Engels, J. A., Landeweerd, J. A., & Kant, Y. (1994). An OWAS-based analysis of nurses' working postures, *Ergonomics*, *37*, 909-919.
- Foreman, T. K., & Troup, J. D. G. (1987). Diurnal variations in spinal loading and the effects on stature: a preliminary study of nursing activities, *Clinical Biomechanics*, *2*, 48-54.
- Fransson-Hall, C., Gloria, R., Kilbom, A., & Winkel, J. (1995). A portable ergonomic observation method (PEO) for computerized on-line recording of postures and manual handling, *Applied Ergonomics*, *26*, 93-100.
- Genaidy, A., Barkawi, H., & Christensen, D. (1995). Ranking of static non-neutral postures around the joints of the upper extremity and the spine, *Ergonomics*, *38*, 1851-1858.

Physical Demands Subcommittee

Content Model and Classification Recommendations

- Graham, B., Lambe, S. R., & Lambe, N. R. (1996). Working practices in a perchery system, using the OVAKO Working posture Analysing System (OWAS), *Applied Ergonomics*, 27, 281-284.
- Hignett, S., & McAtamney, L. (2000). Rapid Entire Body Assessment (REBA), *Applied Ergonomics*, 31, 201-205.
- Holzmann, P. (1982) ARBAN – A new method for analysis of ergonomic effort, *Applied Ergonomics*, 15, 82-86.
- Juul-Kristensen, B., Fallentin, N., & Ekahl, C. (1997). Criteria for classification of posture in repetitive work by observation methods: A review, *International Journal of Industrial Ergonomics*, 19, 397-411.
- Kant, I., Notermans, J. H. V., & Borm, P. J. A. (1990). Observations of working postures in garages using the OVAKO Working Posture Analysing System (OWAS) and consequent workload reduction recommendations, *Ergonomics*, 33, 209-220.
- Karhu, O., Kansil, P., & Kuorinka, I. (1977). Correcting working postures in industry: A practical method for analysis, *Applied Ergonomics*, 8, 199-201.
- Kee, D., & Karwowski, W. (2001). The boundaries for joint angles of isocomfort for sitting and standing males based on perceived comfort of static joint postures, *Ergonomics*, 44, 614-648.
- Kee, D., & Karwowski, W. (2001). LUBA: an assessment technique for postural loading on the upper body based on joint motion discomfort and maximum holding time, *Applied Ergonomics*, 32, 357-366.
- Kilbom, A., Persson, J., & Johnsson, B. G. (1986). Disorders of the cervicobrachial region among female workers in the electronics industry, *International Journal of Industrial Ergonomics*, 1, 37-47.
- Kivi, P., & Mattila, M., (1991). Analysis and improvement of work postures in the building industry: Application of the computerized OWAS method, *Applied Ergonomics*, 22, 43-48.
- Li, G., & Buckle, P. (1999). Current techniques for assessing physical exposure to work-related musculoskeletal risks, with emphasis on posture-based methods, *Ergonomics*, 42, 674-695.

Physical Demands Subcommittee

Content Model and Classification Recommendations

- Mattila, M., Karwowski, W., & Vilkki, M. (1993). Analysis of working postures in hammering tasks on building construction sites using the computerized OWAS method, *Applied Ergonomics*, 24, 405-412.
- Nevela-Puranen, N. (1995). Reduction of farmers' postural load during occupationally oriented medical rehabilitation, *Applied Ergonomics*, 26, 411-415.
- Olendorf, M. R., & Drury, C. G. (2001). Postural discomfort and perceived exertion in standardized box-holding postures, *Ergonomics*, 44, 1341-1367.
- Paquet, V., Punnett, L., Woskie, S., & Buchholz, B. (2005). Reliable exposure assessment strategies for physical ergonomics stressors in construction and other non-routinized work, *Ergonomics*, 48, 1200-1219.
- Rohmert, W. (1985). AET-a new job-analysis method, *Ergonomics*, 28, 245-254.
- Souza, T. O., & Coury, H. J. C. G. (2005). Are the postures adopted according to requested linguistic categories similar to those classified by the recording protocols, *Applied Ergonomics*, 36, 207-212.
- Wiktorin, C., Karlquist, L., & Winkel, J. (1993). Validity of self-reported exposures to work postures and manual materials handling. *Scandinavian Journal of Work, Environmental & Health*, 19, 208-214.
- Wilson, M. A. (2007). A history of Job Analysis, 219-241.

Physical Demands Subcommittee
Content Model and Classification Recommendations

This page left intentionally blank.

Physical Demands Subcommittee

Content Model and Classification Recommendations

Appendix A

Excel Spreadsheet Comparison of Occupational and Ergonomic Classification Schemes

Shoulder Reach Ranges	RULA	REBA	PATH	LUBA	PEO	VIRA	TRAC	DOL 2002 Research
Flexion								
Level 1	0-20	0-20	0 -90	0-45	0-90	0-30	0-60	0-45
Level 2	20-45	20-45	90 +	45-90	90+	30-60	>60	45-90
Level 3	45 -90	45 -90	NA	90-150	NA	60-90	NA	>90
Level 4	90 +	90 +	NA	>150	NA	NA	NA	NA
Extension								
Level 1	NA	0	NA	0-20	NA	>0	NA	NA
Level 2	NA	>20	NA	20-45	NA	NA	NA	NA
Level 3	NA	NA	NA	> 45	NA	NA	NA	NA
Medial Rotation								
Level 1	NA	NA	NA	0-30	NA	NA	NA	NA
Level 2	NA	NA	NA	30-90	NA	NA	NA	NA
Level 3	NA	NA	NA	> 90	NA	NA	NA	NA
Lateral Rotation								
Level 1	NA	NA	NA	0-10	NA	NA	NA	NA
Level 2	NA	NA	NA	30-Oct	NA	NA	NA	NA
Level 3	NA	NA	NA	>30	NA	NA	NA	NA
Abduction								
Level 1	NA	NA	NA	0-30	NA	0-30	0-60	0-45
Level 2	NA	NA	NA	30-90	NA	30-60	>60	45-90
Level 3	NA	NA	NA	>90	NA	60-90	NA	>90
Adduction								
Level 1	NA	NA	NA	0-10	NA	NA	NA	NA
Level 2	NA	NA	NA	30-Oct	NA	NA	NA	NA
Level 3	NA	NA	NA	>30	NA	NA	NA	NA
Elbow Bend Ranges								
Minimal	NA	60 - 100	NA	0-45	NA	NA	NA	NA
Moderate				45-120	NA	NA	NA	NA
Severe	NA	<60; > 100	NA	>120	NA	NA	NA	NA
Wrist Ranges								
Flexion								
Minimal	0-15	0-15	NA	0-20	NA	NA	NA	NA
Moderate				20-60	NA	NA	NA	NA
Severe	>15	>15	NA	>60	NA	NA	NA	NA
Extension								
Level 1	NA	NA	NA	0-20	NA	NA	NA	NA
Level 2	NA	NA	NA	20-40	NA	NA	NA	NA
Level 3	NA	NA	NA	>45	NA	NA	NA	NA

Physical Demands Subcommittee

Content Model and Classification Recommendations

Appendix A

Excel Spreadsheet Comparison of Occupational and Ergonomic Classification Schemes (continued)

Wrist Ranges (cont'd)	RULA	REBA	PATH	LUBA	PEO	VIRA	TRAC	DOL 2002 Research
Twisting/Pronation								
Neutral	No #	No #	NA	0-70	NA	NA	NA	NA
Non-Neutral	No #	No #	NA	>70	NA	NA	NA	NA
Twisting/Supination								
Neutral	No #	No #	NA	0-90	NA	NA	NA	NA
Non-Neutral	No #	No #	NA	>90	NA	NA	NA	NA
Radial Deviation								
Level 1	No #	No #	NA	0-10	NA	NA	NA	NA
Level 2	No #	No #	NA	30-Oct	NA	NA	NA	NA
Level 3	NA	NA	NA	>30	NA	NA	NA	NA
Ulnar Deviation								
Level 1	No #	No #	NA	0-10	NA	NA	NA	NA
Level 2	No #	No #	NA	20-Oct	NA	NA	NA	NA
Level 3	NA	NA	NA	>20	NA	NA	NA	NA
Trunk Ranges								
Flexion								
Level 1	0-20	0-20	0-20	0-20	0-20	NA	0-15	0-35
Level 2	20 - 60	20 - 60	20-45	20 - 60	21-60	NA	15-45	>35
Level 3	60 +	60 +	> 45	>60	> 60	NA	45-75	NA
Level 4	NA	NA	NA	NA	NA	NA	>75	NA
Ext								
Min	NA	0 - 20	NA	NA	NA	NA	NA	NA
Mod	NA	> 20	NA	NA	NA	NA	NA	NA
Twist								
Level 1	0	0	0-20	0-20	0-45	NA	NA	No #
Level 2	> 0	> 0	> 20	20-30	> 45	NA	NA	No #
Level 3	NA	NA	NA	30-45	NA	NA	NA	No #
Level 4	NA	NA	NA	>45	NA	NA	NA	No #
Side bend								
Level 1	0	0	0-20	0-10	NA	NA	NA	NA
Level 2	> 0	> 0	> 20	10 to 20	NA	NA	NA	NA
Level 3	NA	NA	NA	20-30	NA	NA	NA	NA
Level 4	NA	NA	NA	>30	NA	NA	NA	NA
Neck Ranges								
Flexion								
Min	0-10	0-20	0-30	0-20	0-20	0-20	NA	No #
Mod	10 to 20		NA	20-45	NA	>20	NA	No #
Sev	20 +	20+	> 30	>45	> 20	NA	NA	No #
Ext								
Min	NA	0-20	NA	0-30	NA	NA	NA	No #
Mod	NA		NA	30-60	NA	NA	NA	No #
Sev	NA	20+	NA	>60	NA	NA	NA	No #

Physical Demands Subcommittee

Content Model and Classification Recommendations

APPENDIX A

Excel Spreadsheet Comparison of Occupational and
Ergonomic Classification Schemes
(continued)

Neck Ranges (cont'd)	RULA	REBA	PATH	LUBA	PEO	VIRA	TRAC	DOL 2002 Research
Twist								
Level 1	0	0	0-45	0-30	0-45	NA	NA	No #
Level 2	> 0	> 0	> 45	30-60	> 45	NA	NA	No #
Level 3				>60				
Side bend								
Level 1	0	0	0-30	0-30	NA	NA	NA	No #
Level 2	> 0	> 0	> 30	30-45	NA	NA	NA	No #
Level 3				>45	NA	NA	NA	No #
Squat								> 45 knee flexion
Walk/Climb								3 consecutive steps
NA = Category not used; joint position not classified								
No # = Category/ joint position classified but no specific ROM criteria provided								