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(54) **SYSTEM FOR DETERMINING PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS BASED ON PRIORITIZED DATA**

(71) Applicant: **Ansell Limited**, Richmond (AU)

(72) Inventors: **Louis A. Zircher, IV**, Monmouth Junction, NJ (US); **Raymond W. Morris**, Newark, OH (US)

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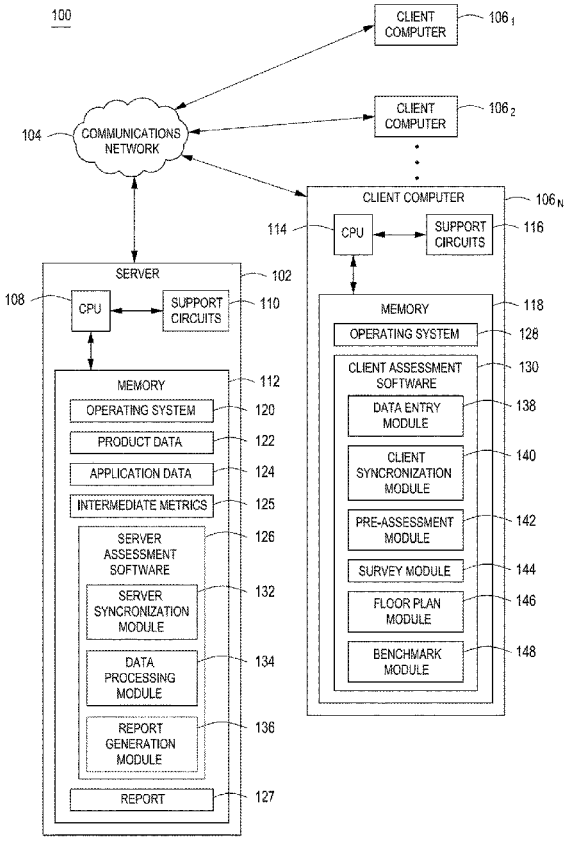
(57) **ABSTRACT**

A system for computing personal protective equipment (PPE) recommendations, including a plurality of client computers, where each client computer in the plurality of client computers, uses a processor, for receiving and storing corporate information of a corporate organization and PPE needs associated with the corporate organization; and for receiving and storing a plurality of benchmark data describing a current PPE usage for at least one application of the PPE within the corporate organization; and a server, remotely located from the plurality of client computers and connected to the plurality of client computers via a network, for identifying a selected PPE by performing an analysis based on the corporate information and the benchmark data wherein the analysis compares characteristics of a plurality PPE against characteristics of the at least one application and provides a priority ranking of importance for the plurality of characteristics required for the at least one application.



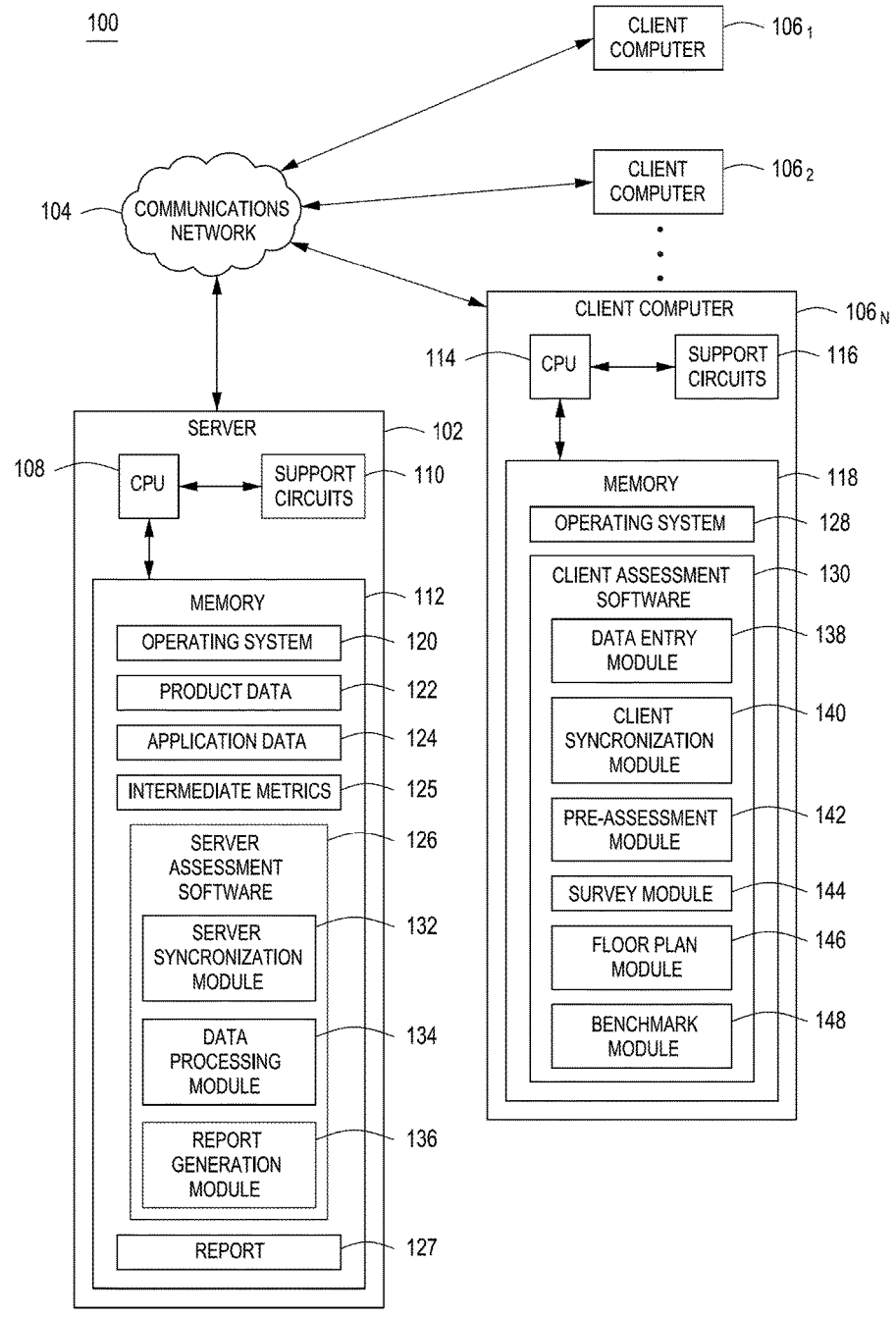

100
CLIENT COMPUTER
106_1
106_2
104
COMMUNICATIONS NETWORK
CLIENT COMPUTER
CLIENT COMPUTER
106_N
114
CPU
SUPPORT CIRCUITS
116
SERVER
102
108
CPU
SUPPORT CIRCUITS
110
MEMORY
118
OPERATING SYSTEM
128
CLIENT ASSESSMENT SOFTWARE
130
DATA ENTRY MODULE
138
CLIENT SYNCRONIZATION MODULE
140
PRE-ASSESSMENT MODULE
142
SURVEY MODULE
144
FLOOR PLAN MODULE
146
BENCHMARK MODULE
148
MEMORY
112
OPERATING SYSTEM
120
PRODUCT DATA
122
APPLICATION DATA
124
INTERMEDIATE METRICS
125
SERVER ASSESSMENT SOFTWARE
126
SERVER SYNCRONIZATION MODULE
132
DATA PROCESSING MODULE
134
REPORT GENERATION MODULE
136
REPORT
127

FIG. 1

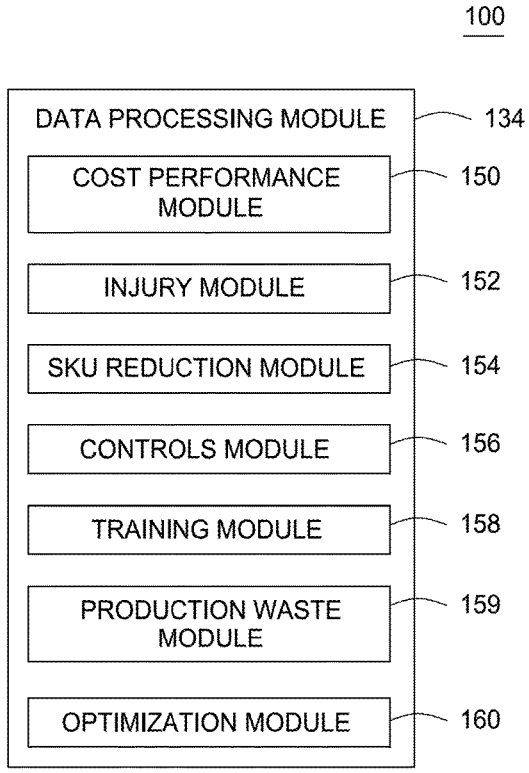

100
DATA PROCESSING MODULE
134
COST PERFORMANCE MODULE
150
INJURY MODULE
152
SKU REDUCTION MODULE
154
CONTROLS MODULE
156
TRAINING MODULE
158
PRODUCTION WASTE MODULE
159
OPTIMIZATION MODULE
160

FIG. 1A

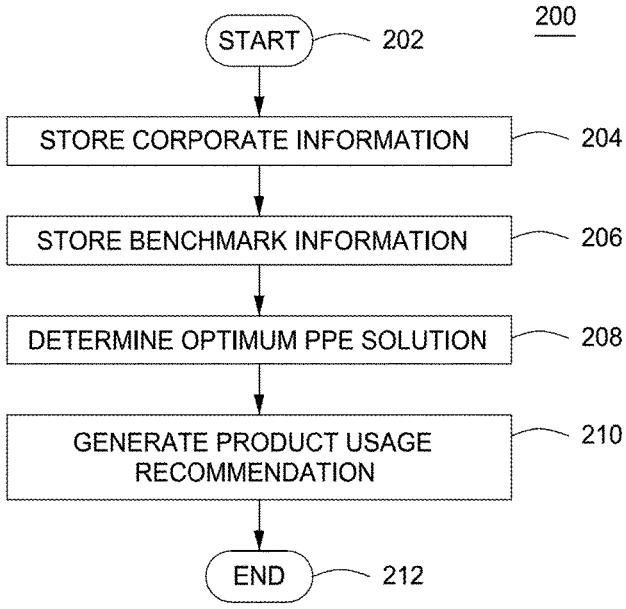

200
START
202
STORE CORPORATE INFORMATION
204
STORE BENCHMARK INFORMATION
206
DETERMINE OPTIMUM PPE SOLUTION
208
GENERATE PRODUCT USAGE RECOMMENDATION
210
END
212

FIG. 2

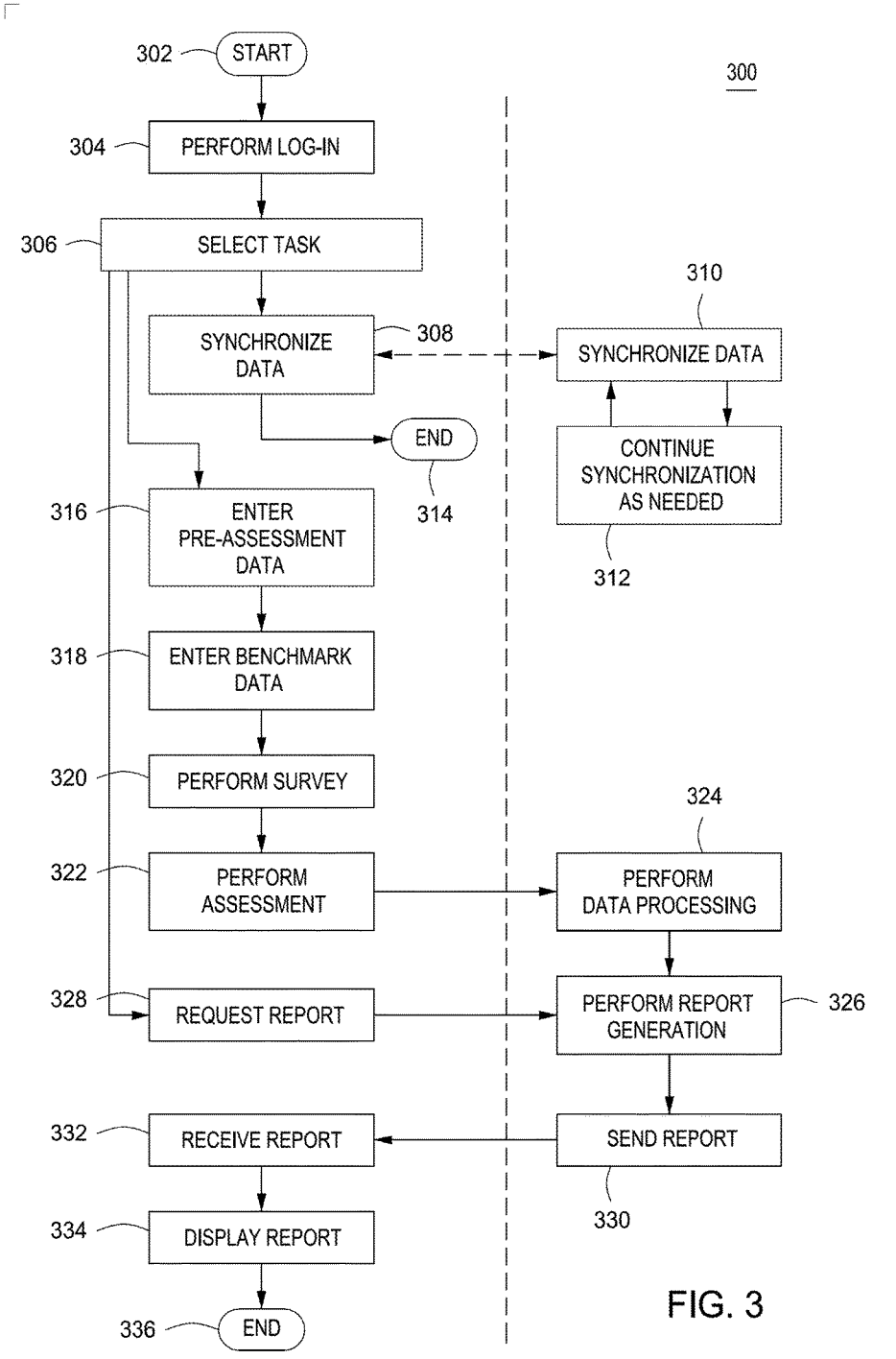

300
302
START
304
PERFORM LOG-IN
306
SELECT TASK
SYNCHRONIZE DATA
308
310
SYNCHRONIZE DATA
END
314
CONTINUE SYNCHRONIZATION AS NEEDED
312
316
ENTER PRE-ASSESSMENT DATA
318
ENTER BENCHMARK DATA
320
PERFORM SURVEY
322
PERFORM ASSESSMENT
324
PERFORM DATA PROCESSING
328
REQUEST REPORT
PERFORM REPORT GENERATION
326
332
RECEIVE REPORT
SEND REPORT
330
334
DISPLAY REPORT
336
END

FIG. 3

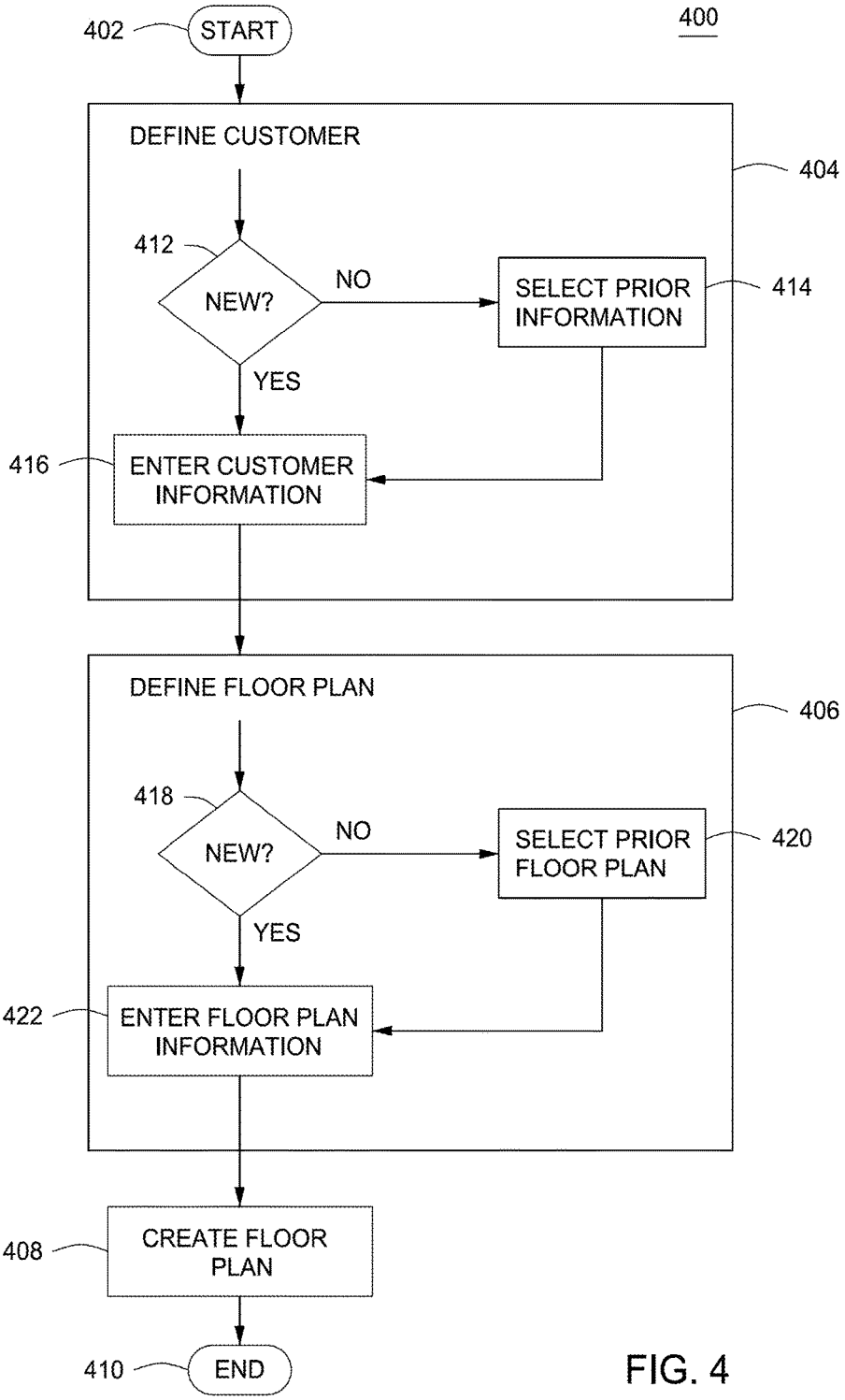

400
402
START
DEFINE CUSTOMER
404
412
NEW?
NO
SELECT PRIOR INFORMATION
414
YES
416
ENTER CUSTOMER INFORMATION
DEFINE FLOOR PLAN
406
418
NEW?
NO
SELECT PRIOR FLOOR PLAN
420
YES
422
ENTER FLOOR PLAN INFORMATION
408
CREATE FLOOR PLAN
410
END

FIG. 4

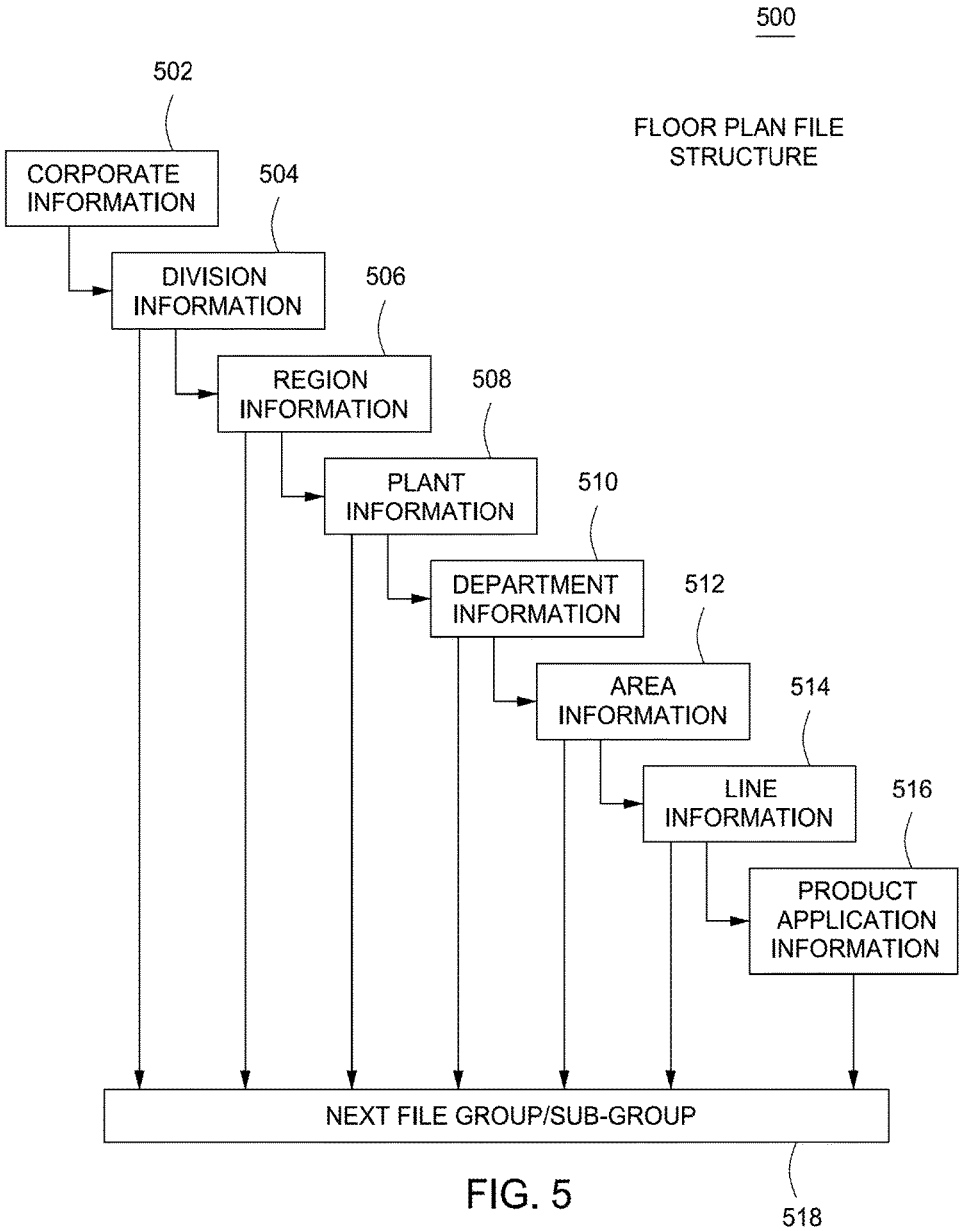

500
FLOOR PLAN FILE STRUCTURE
502
CORPORATE INFORMATION
504
DIVISION INFORMATION
506
REGION INFORMATION
508
PLANT INFORMATION
510
DEPARTMENT INFORMATION
512
AREA INFORMATION
514
LINE INFORMATION
516
PRODUCT APPLICATION INFORMATION
NEXT FILE GROUP/SUB-GROUP
518

FIG. 5

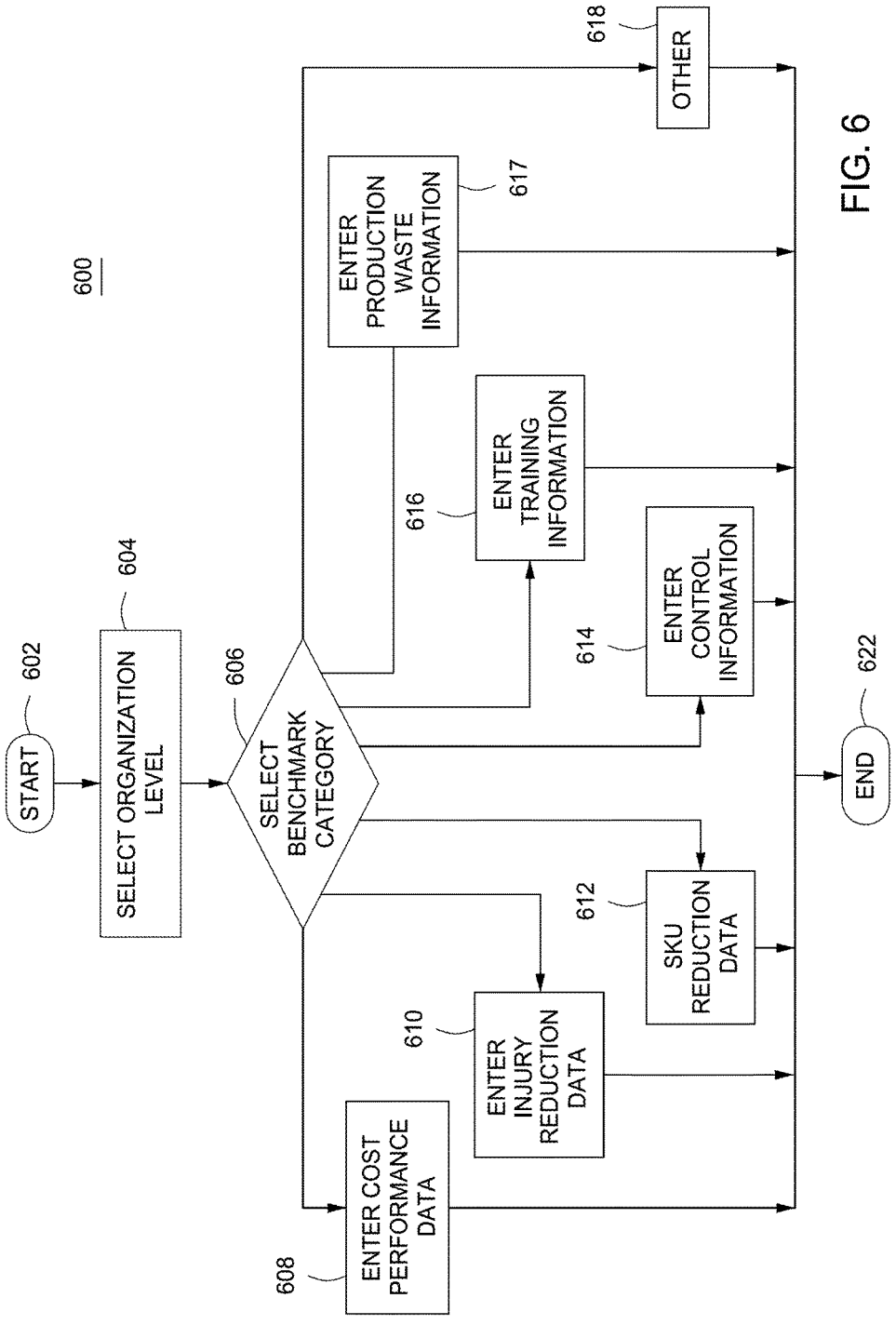

600
START
602
SELECT ORGANIZATION LEVEL
604
SELECT BENCHMARK CATEGORY
606
ENTER COST PERFORMANCE DATA
608
ENTER INJURY REDUCTION DATA
610
SKU REDUCTION DATA
612
ENTER CONTROL INFORMATION
614
ENTER TRAINING INFORMATION
616
ENTER PRODUCTION WASTE INFORMATION
617
OTHER
618
END
622

FIG. 6

700

CLIENT STOCK NO.	PRODUCT STYLE	PRODUCT CATEGORY	PRODUCT BRAND	CURRENT ANNUAL USAGE QUANTITY	UNIT OF MEASURE	NUMBER OF SIZES USED	PURCHASE PRICE
AVG LIFE SPAN OF PRODUCT	CURRENTLY LAUNDER THIS PRODUCT Y/N	HOW MANY TIMES DOES THE PRODUCT LAUNDER?	COST PER PAIR OR EACH TO LAUNDER?	AVERAGE INVENTORY ON-HAND $	OPTIONAL METHOD: AVERAGE INVENTORY ON-HANDS	OPTIONAL METHOD: AVERAGE INVENTORY ON-HANDS	
TABLE							

FIG. 7A

702

INJURY NAME	TOTAL OSHA RECORDABLE INJURIES	ANNUAL MEDICAL RECORDABLE TOTAL COST	ANNUAL INDEMNITY COST RECORDABLE	TOTAL ANNUAL NON RECORDABLE INJURIES	ANNUAL MEDICAL COST FOR NON RECORDABLE	TOTAL WORK DAYS LOST	HIDDEN COST
TABLE							

FIG. 7B

704

INJURY NAME	INJURY PARTICULARS NAME	OSHA INJURIES	DEPARTMENT HAVING HIGHEST NO. OF OSHA RECORDABLE INJURY	ANNUAL NON RECORDABLE INJURIES
DEPT. WITH HIGHEST NO. OF INJURIES	TOTAL WORK DAYS LOST	ESTIMATED NO. OF PREVENTABLE RECORDABLES IF PROPER HAND/APPAREL PROTECTION WAS UTILIZED	ESTIMATED NO. OF PREVENTABLE NON RECORDABLES IF PROPER HAND/APPAREL PROTECTION WAS UTILIZED	ESTIMATED NO. OF LOST DAYS THAT COULD HAVE BEEN PREVENTED WITH PROPER HAND PROTECTION
TABLE				

FIG. 7C

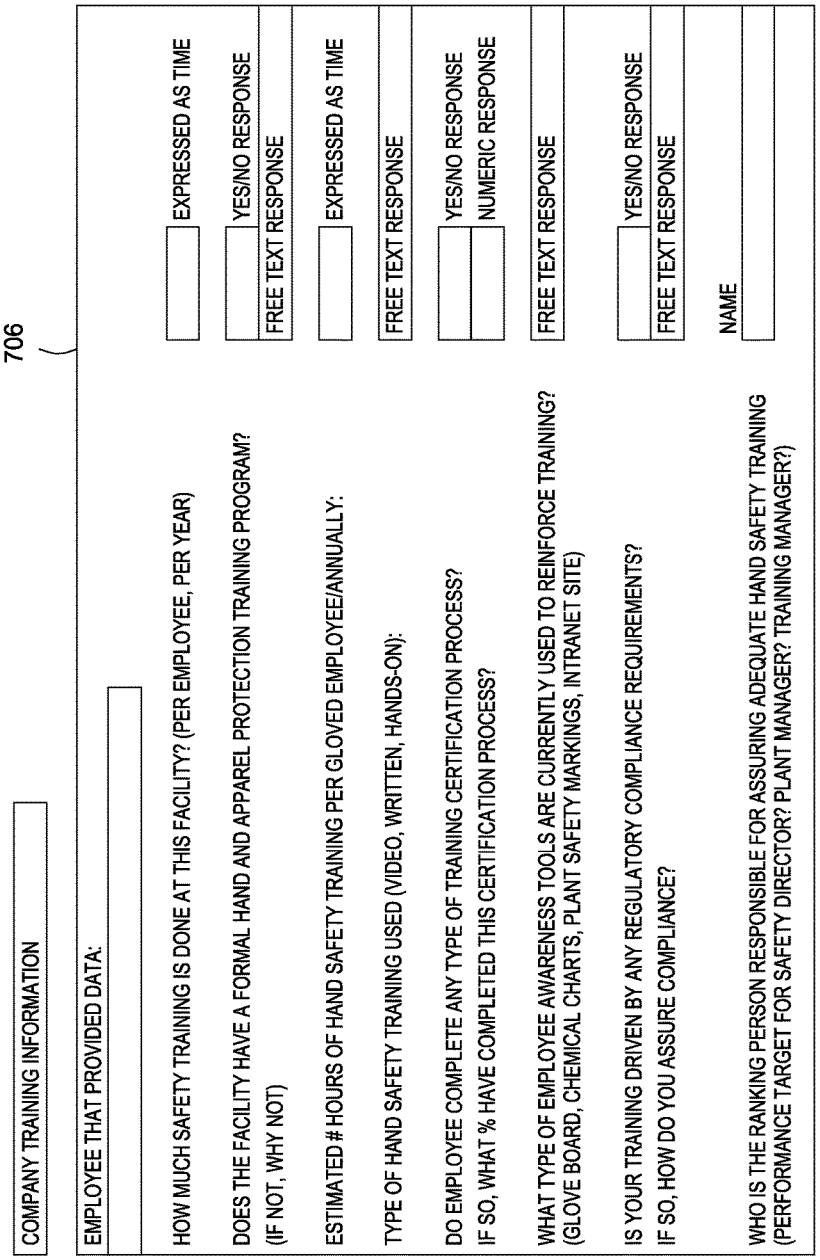

706
COMPANY TRAINING INFORMATION
EMPLOYEE THAT PROVIDED DATA:
HOW MUCH SAFETY TRAINING IS DONE AT THIS FACILITY? (PER EMPLOYEE, PER YEAR)
EXPRESSED AS TIME
DOES THE FACILITY HAVE A FORMAL HAND AND APPAREL PROTECTION TRAINING PROGRAM? (IF NOT, WHY NOT)
YES/NO RESPONSE
FREE TEXT RESPONSE
ESTIMATED # HOURS OF HAND SAFETY TRAINING PER GLOVED EMPLOYEE/ANNUALLY:
EXPRESSED AS TIME
TYPE OF HAND SAFETY TRAINING USED (VIDEO, WRITTEN, HANDS-ON):
FREE TEXT RESPONSE
DO EMPLOYEE COMPLETE ANY TYPE OF TRAINING CERTIFICATION PROCESS?
IF SO, WHAT % HAVE COMPLETED THIS CERTIFICATION PROCESS?
YES/NO RESPONSE
NUMERIC RESPONSE
WHAT TYPE OF EMPLOYEE AWARENESS TOOLS ARE CURRENTLY USED TO REINFORCE TRAINING? (GLOVE BOARD, CHEMICAL CHARTS, PLANT SAFETY MARKINGS, INTRANET SITE)
FREE TEXT RESPONSE
IS YOUR TRAINING DRIVEN BY ANY REGULATORY COMPLIANCE REQUIREMENTS?
IF SO, HOW DO YOU ASSURE COMPLIANCE?
YES/NO RESPONSE
FREE TEXT RESPONSE
WHO IS THE RANKING PERSON RESPONSIBLE FOR ASSURING ADEQUATE HAND SAFETY TRAINING (PERFORMANCE TARGET FOR SAFETY DIRECTOR? PLANT MANAGER? TRAINING MANAGER?)
NAME

FIG. 7D

708

DEFECTS	
TOTAL NUMBER OF UNITS SCRAPPED OR SPOILED IN THE LAST 12 MONTHS	–
DOLLAR VALUE OF PRODUCT SCRAP/SPOILED IN THE LAST 12 MONTHS	$ –
NUMBER OF UNITS REWORKED IN LAST 12 MONTHS	–
DOLLAR VALUE OF REWORK IN THE LAST 12 MONTHS	$ –
OVER PRODUCTION	
TOTAL FLOOR SPACE AREA TAKEN UP BY WIP INVENTORY	–
AVERAGE ANNUAL COST PER SQ FT. (TOTAL FACILITY COST/TOTAL SQ FT.)	$ –
DOLLAR VALUE OF WIP INVENTORY	$ –
INVENTORY COST	$ –
TRANSPORTATION	
AVERAGE DISTANCE (IN FEET) A WORKER TRAVELS PER DAY TO OBTAIN/DISPOSE OF PPE	–
AVERAGE AMOUNT OF TIME TO TRAVEL PER DAY TO OBTAIN/DISPOSE OF PPE	–
AVERAGE NUMBER OF WORKERS PER DAY	–
NUMBER OF WORKDAYS PER YEAR	–
AVERAGE WORKER LOADED COST PER HOUR	$ –
WAITING	
TOTAL ANNUAL LOST TIME	–
AVERAGE WORKER LOADED COST PER HOUR	$ –
INVENTORY	
TOTAL FLOOR SPACE AREA TAKEN UP (IN SQ FT.) BY PPE INVENTORY	0
AVERAGE ANNUAL COST PER SQ FT. (TOTAL FACILITY COST/TOTAL SQ FT.)	$ 0
FLOOR SPACE COST	$ –
DOLLAR VALUE OF PPE INVENTORY (AVERAGE INVENTORY ON HAND)	$ –
INVENTORY COST	$ –
MOTION	
NO. OF ERGONOMIC HEALTH AND SAFETY INCIDENTS IN THE LAST 12 MONTHS	–
DOLLAR VALUE OF ERGONOMIC HEALTH AND SAFETY INCIDENTS IN THE LAST 12 MONTHS	$ –
PROCESSING	
AVERAGE COMPENSABLE TIME FOR DONNING / DOFFING PER WORKER	–
AVERAGE NUMBER OF WORKERS PER DAY	–
NUMBER OF WORKDAYS PER YEAR	–
AVERAGE WORKER LOADED COST PER HOUR	$ –

FIG. 7E

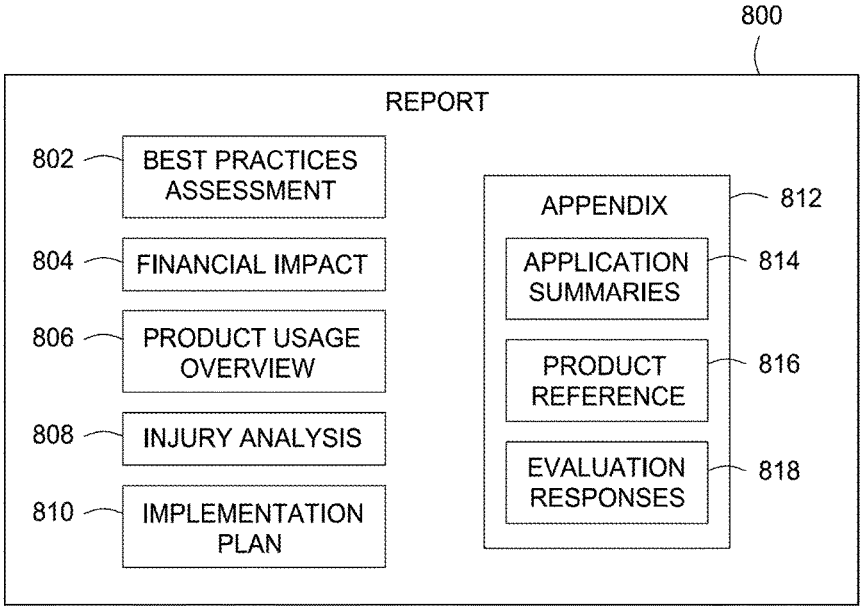

800
REPORT
802
BEST PRACTICES ASSESSMENT
804
FINANCIAL IMPACT
806
PRODUCT USAGE OVERVIEW
808
INJURY ANALYSIS
810
IMPLEMENTATION PLAN
APPENDIX
812
APPLICATION SUMMARIES
814
PRODUCT REFERENCE
816
EVALUATION RESPONSES
818

FIG. 8

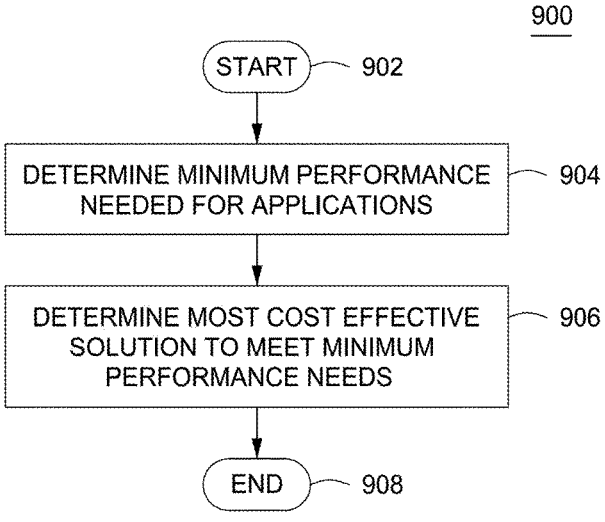

900
START
902
DETERMINE MINIMUM PERFORMANCE NEEDED FOR APPLICATIONS
904
DETERMINE MOST COST EFFECTIVE SOLUTION TO MEET MINIMUM PERFORMANCE NEEDS
906
END
908

FIG. 9

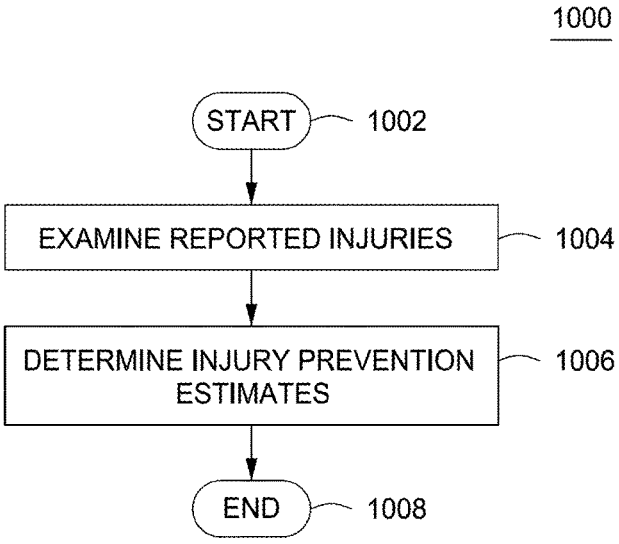

1000
START
1002
EXAMINE REPORTED INJURIES
1004
DETERMINE INJURY PREVENTION ESTIMATES
1006
END
1008

FIG. 10

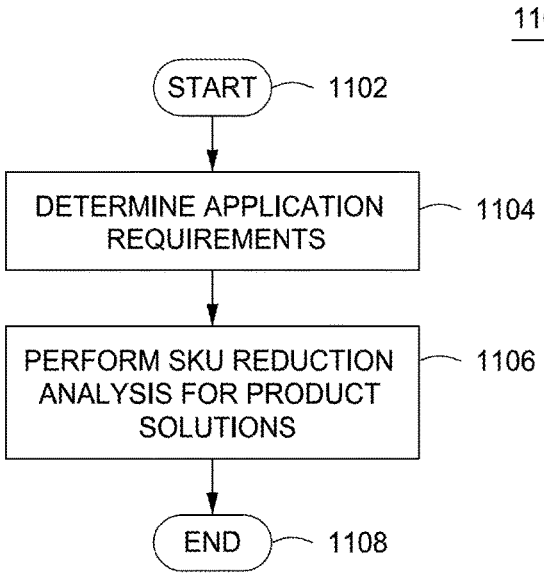

1100
START
1102
DETERMINE APPLICATION REQUIREMENTS
1104
PERFORM SKU REDUCTION ANALYSIS FOR PRODUCT SOLUTIONS
1106
END
1108

FIG. 11

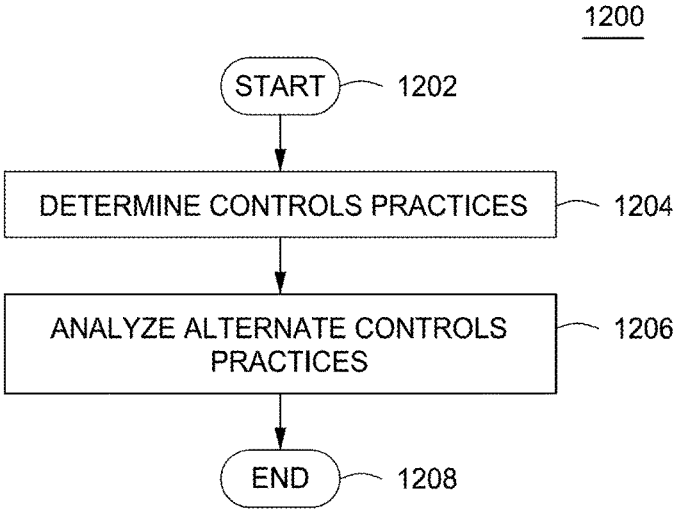

1200
START
1202
DETERMINE CONTROLS PRACTICES
1204
ANALYZE ALTERNATE CONTROLS PRACTICES
1206
END
1208

FIG. 12

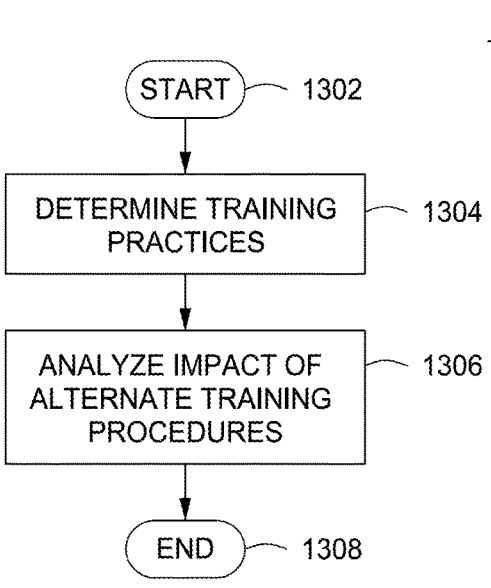

1300
START
1302
DETERMINE TRAINING PRACTICES
1304
ANALYZE IMPACT OF ALTERNATE TRAINING PROCEDURES
1306
END
1308

FIG. 13

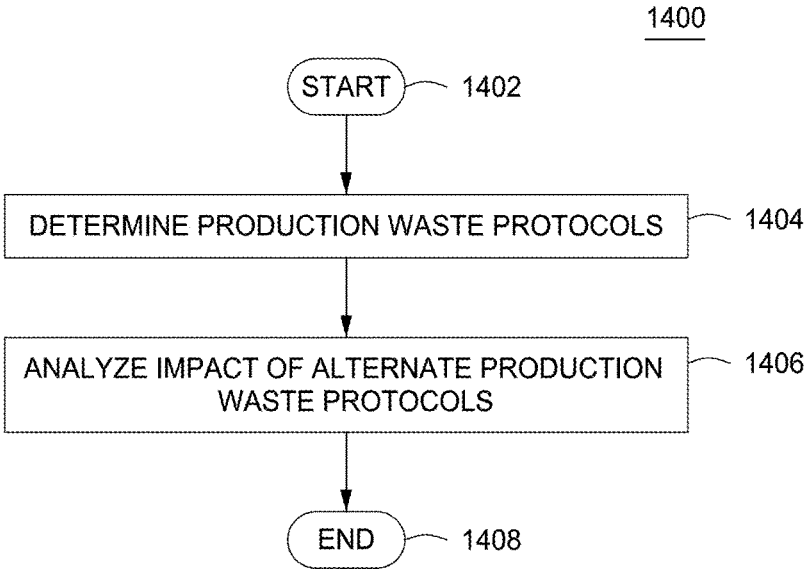

1400
START
1402
DETERMINE PRODUCTION WASTE PROTOCOLS
1404
ANALYZE IMPACT OF ALTERNATE PRODUCTION WASTE PROTOCOLS
1406
END
1408

FIG. 14

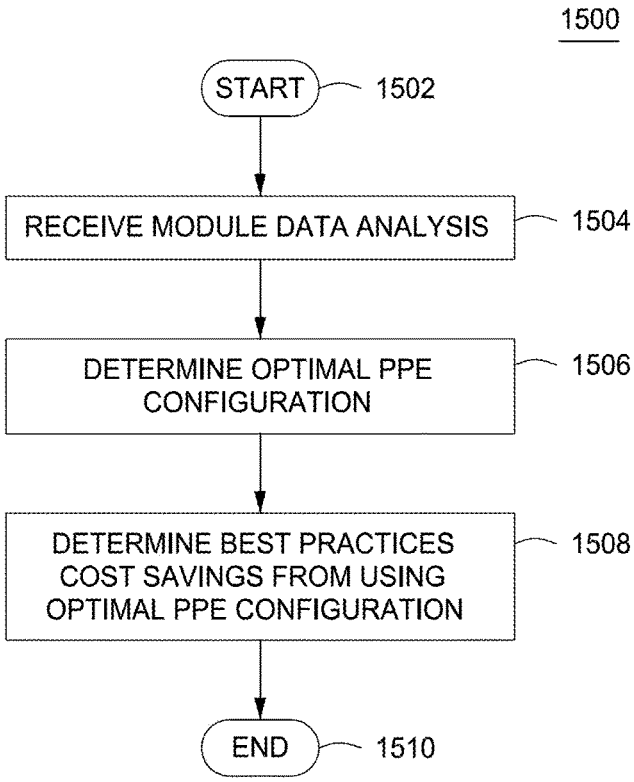

1500
START
1502
RECEIVE MODULE DATA ANALYSIS
1504
DETERMINE OPTIMAL PPE CONFIGURATION
1506
DETERMINE BEST PRACTICES COST SAVINGS FROM USING OPTIMAL PPE CONFIGURATION
1508
END
1510

FIG. 15

SYSTEM FOR DETERMINING PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS BASED ON PRIORITIZED DATA

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 14/453,972, filed on Aug. 7, 2014, which is a continuation of U.S. patent application Ser. No. 13/362,336, filed on Jan. 31, 2012 and granted on Aug. 26, 2014 as U.S. Pat. No. 8,818,830, which claims priority to U.S. Provisional Patent Application Ser. No. 61/462,330 filed Jan. 31, 2011, each of which is incorporated by reference herein in its entirety.

BACKGROUND

Technical Field

[0002] Embodiments generally relate to a method and system for optimization, and, more particularly, to a method and system for computing optimal product usage based on product suitability, inventory controls, injury reduction, and cost.

Description of the Related Art

[0003] Personal protective equipment (PPE) is used in a variety of different fields, including construction, maintenance, fabrication, industrial, engineering, research, healthcare, development, and military uses. As such, a wide variety of different types of PPE have been developed to suit the specific needs of each endeavor. PPE is typically rated on a variety of metrics indicating suitability for a particular task. However, the decision for which PPE to use for a given task is not always a simple one. The types of hazards present in the workplace and what injuries may occur from those hazards are considerations in choosing the right PPE. In an industrial setting, most injuries come from four main hazard categories, namely chemicals, abrasions, cutting, and thermal (heat or cold). Common hand injuries include lacerations or cuts to the hand and arm, amputation of the hand, loss of a finger, burns by chemicals or by fire, broken pieces of material becoming lodged into the hand, and crush injuries resulting in broken bones. A fabric glove may protect hands from dirt, chafing and abrasions, but will not protect the hand from rough, sharp, or heavy objects. A thicker glove may be required for use with chemicals, while the task may also require a glove that is flexible, yet slip resistant. The severity of the chemical hazard (splash/immersion) may be a consideration as well as the grip required in an outdoor or humid environment. Some common types of protective work gloves include disposable gloves to guard against mild irritants, fabric gloves to improve grip and insulate hands from mild heat and cold, leather gloves to guard against injuries from sparks or scraping against rough surfaces, metal mesh gloves for use with cutting tools or other sharp instruments, aluminized gloves to insulate hands from extreme heat when working with, for example, molten materials, and chemical resistant gloves to protect hands from corrosives, oils, and solvents. There currently exist methods that determine the right glove or PPE for a given application.

[0004] However, the least expensive PPE for a given application is not necessarily the most cost effective solution. There are various costs associated with using a lower cost or lesser appropriate PPE for a given application. These include, a loss of productivity due to the injured employee being out of work, the cost of replacing the PPE, and the cost of the actual medical expenses associated with the injury to name a few. Costs associated with a particular PPE may include the average lifespan of the PPE or the costs of laundering versus disposing of the PPE. However, a higher cost PPE that results in fewer injuries to employees, thereby decreasing those costs associated with injuries can result in an overall savings for the company.

[0005] As such, there is a need in the art for a method and system for computing optimal product usage that enables a PPE consumer to optimize their product purchasing decisions to fulfill PPE needs.

SUMMARY

[0006] Embodiments including a method and system for computing optimal product usage are disclosed. In one embodiment, a computer implemented method of computing optimal product comprises: storing corporate information as a floor plan containing a plurality of hierarchical levels of a corporate organization, storing benchmark data describing a current product usage for at least one application within the corporate organization, performing an analysis based on the corporate information and the benchmark data to determine an optimum usage of a plurality of products for the at least one application, and recommending a product usage based on the determined optimum usage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a simplified block diagram of a system for computing optimal product usage according to one or more embodiments;

[0008] FIG. **1**A is a block diagram of the modules comprising a data processing module of FIG. **1** in accordance with one embodiment of the invention;

[0009] FIG. **2** is a flow diagram illustrating a method for computing optimal product usage according to one or more embodiments;

[0010] FIG. **3** is a flow diagram illustrating a method for computing optimal product usage according to one or more embodiments;

[0011] FIG. **4** is a flow diagram illustrating a method for creating a site survey for a product usage analysis report according to one or more embodiments;

[0012] FIG. **5** is a block diagram depicting a file structure for a product usage analysis report according to one or more embodiments;

[0013] FIG. **6** is a flow diagram illustrating a method for entering data to a file used to generate a product usage analysis report according to one or more embodiments;

[0014] FIGS. **7**A-**7**E are illustrative diagrams of data tables used to generate a product usage analysis report according to one or more embodiments;

[0015] FIG. **8** is a block diagram depicting a structure of a product usage analysis report according to one or more embodiments;

[0016] FIG. **9** is a flow diagram illustrating a method for generating a cost performance analysis report according to one or more embodiments;

[0017] FIG. **10** is a flow diagram illustrating a method for generating an injury reduction analysis report according to one or more embodiments;

[0018] FIG. **11** is a flow diagram illustrating a method for generating a SKU reduction data analysis report according to one or more embodiments;

[0019] FIG. **12** is a flow diagram illustrating a method for generating a controls information analysis report according to one or more embodiments;

[0020] FIG. **13** is a flow diagram illustrating a method for generating a training information analysis report according to one or more embodiments;

[0021] FIG. **14** is a flow diagram illustrating a method for generating a production waste analysis report according to one or more embodiments; and

[0022] FIG. **15** is a flow diagram illustrating a method for generating an equipment analysis report according to one or more embodiments.

[0023] While the method and apparatus for computing optimal product usage are described herein by way of example for several embodiments and illustrative drawings, those skilled in the art will recognize that the method and apparatus for computing optimal product usage are not limited to the embodiments or drawings described. It should be understood, that the drawings and detailed description thereto are not intended to limit embodiments to the particular form disclosed. Rather, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the method and apparatus for computing optimal product usage as defined by the appended claims. Any headings used herein are for organizational purposes only and are not meant to limit the scope of the description or the claims. As used herein, the word "may" is used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense (i.e., meaning must). Similarly, the words "include", "including", and "includes" mean including, but not limited to.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Various embodiments of a computer implemented method and system for computing optimal product usage are disclosed herein. The product usage analysis combines data regarding corporate information, organizational information, product and product application information, financial information and the like. This data is processed to produce a product usage analysis report that may suggest improvements in product purchasing and usage patterns. One embodiment of the invention analyzes product use as personal protective equipment (PPE), for example, industrial gloves. In another embodiment, the PPE may be medical gloves, e.g., examination or surgical gloves. In other embodiments, other products may be analyzed to assess product usage.

[0025] In the following detailed description, numerous specific details are set forth to provide a thorough understanding of claimed subject matter. However, it will be understood by those skilled in the art that claimed subject matter may be practiced without these specific details. In other instances, methods, apparatuses or systems that would be known by one of ordinary skill have not been described in detail so as not to obscure claimed subject matter.

[0026] Some portions of the detailed description that follow are presented in terms of algorithms or symbolic representations of operations on binary digital signals stored within a memory of a specific apparatus or special purpose computing device or platform. In the context of this particular specification, the term specific apparatus or the like includes a general purpose computer once it is programmed to perform particular functions as a specific purpose computer pursuant to instructions from program software. Algorithmic descriptions or symbolic representations are examples of techniques used by those of ordinary skill in the signal processing or related arts to convey the substance of their work to others skilled in the art. An algorithm is here, and is generally, considered to be a self-consistent sequence of operations or similar signal processing leading to a desired result. In this context, operations or processing involve physical manipulation of physical quantities. Typically, although not necessarily, such quantities may take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared or otherwise manipulated or transformed. It has proven convenient at times, principally for reasons of common usage, to refer to such signals as bits, data, values, elements, symbols, characters, terms, numbers, numerals or the like. It should be understood, however, that all of these or similar terms are to be associated with appropriate physical quantities and are merely convenient labels. Unless specifically stated otherwise, as apparent from the following discussion, it is appreciated that throughout this specification discussions utilizing terms such as "processing," "computing," "calculating," "determining" or the like refer to actions or processes of a specific apparatus, such as a special purpose computer or a similar special purpose electronic computing device. In the context of this specification, therefore, a special purpose computer or a similar special purpose electronic computing device is capable of manipulating or transforming signals, typically represented as physical electronic or magnetic quantities within memories, registers, or other information storage devices, transmission devices, or display devices of the special purpose computer or similar special purpose electronic computing device. Exemplary embodiments of the present invention are directed towards "personal protective equipment." Personal protective equipment (PPE) and PPE products are broadly defined as gloves, masks, goggles, aprons, helmets, and any other equipment that is might be worn by a user for protection during a task.

[0027] FIG. **1** is a simplified block diagram of a system **100** for computing optimal product usage which may include generating a product usage analysis report. The system **100** includes a server **102**, a communications network **104**, and one or more client computers $\mathbf{106}_1$, $\mathbf{106}_2$ . . . $\mathbf{106}_n$. The client computers **106** communicate with the server **102** via the communications network **104**. In operation, the client computers **106** send and receive data to and from the server **102** to generate product usage analysis reports.

[0028] The server **102** comprises a central processing unit (CPU) **108**, a plurality of support circuits **110** and a memory **112**. The support circuits **110** may include a display device as well as other circuits to support the functionality of the CPU **108**. Such circuits may include clock circuits, cache, power supplies, network cards, video circuits and the like.

[0029] The memory **112** may comprise read only memory, random access memory, removable memory, disk drives, optical drives and/or other forms of digital storage. The memory **112** is configured to store an operating system **120**, product data **122**, application data **124**, server assessment

software **126**, a set of intermediate metrics **125**, and one or more reports **127**. The operating system **120** executes to control the general operation of the server **102**, including facilitating the execution of various processes and modules to perform specific tasks. The server assessment software **126** utilizes the product data **122**, the application data **124**, and data received from the one or more client computers **106** to generate the report **127**.

[0030] The server assessment software **126** comprises a server synchronization module **132**, a data processing module **134**, and a report generation module **136**. The server synchronization module **126** facilitates the transfer of data to and from the one or more client computers **106**. The data processing module **134** processes the data received from the client computers **106** along with the product data **122** and application data **124** to generate a set of intermediate metrics **125**. The product data **122** is data that describes the price, performance characteristics, and capabilities of various products, for example, personal protective equipment products. Application data **124** is data describing the necessary characteristics of various activities which require the product, and the threshold levels of characteristics for performing said activities. For PPE products, exemplary characteristics include tear resistance, strength, crushing resistance, flammability, flexibility, chemical resistance, liquid impermeability, and the like. While the present exemplary embodiment describes the product data **122** and application data **124** as present on the server **102**, one of ordinary skill in the art would recognize that such data could be provided on a remote server or computer. In some embodiments, the product data **122** or application data **124** may be provided by a remote public database that provides information as determined by various standards bodies for a variety of products and/or applications. As depicted in FIG. **1**A, the data processing module **134** comprises a plurality of analysis modules, such as a cost performance module **150**, an injury module **152**, a SKU reduction module **154**, a controls module **156**, a training module **158**, a production waste module **159**, and an optimization module **160**. The operation of each of these modules is described further with respect to FIGS. **8-13**. In brief, the modules **150-159** perform analysis on various aspects of PPE use at the given site, and the optimization module **160** aggregates the analyses to determine an optimal PPE solution.

[0031] The report generation module **136** uses the set of intermediate metrics **125** to produce a report **127**.

[0032] The communications network **104** facilitates communication among the server **102** and the one or more client computers **106**. The communications network **104** may be any sort of wired or wireless network as well as combinations thereof as commonly known in the art. In some embodiments the communications network **104** is at least, in part, a packet switched network, such as the Internet.

[0033] The client computer **106** provides data to and receives data from the server **102**. The client computer **106** comprises a plurality of computing devices including, but not limited to, desktop computers, laptop computers, notebook computers, smart phones, tablet computers, and/or any other computing device capable of executing the client assessment software **130** and interacting with the server **102**. When programmed by certain software, the client computer **106** functions as a specific purpose computer for the purpose of sending and receiving data to the server **102** to generate product usage analysis reports. In some embodiments, the client computer **106** is a portable device that can be transported to and from a facility for the entry of survey data. The client computer **106** comprises a CPU **114**, a plurality of support circuits **116**, and a memory **118**.

[0034] The support circuits **116** may include a display device as well as other circuits to support the functionality of the CPU **114**. Such circuits may include clock circuits, cache, power supplies, network cards, video circuits and the like.

[0035] The memory **118** may comprise read only memory, random access memory, removable memory, disk drives, optical drives and/or other forms of digital storage. The memory **118** is configured to store an operating system **128** and client assessment software **130**. The client assessment software **130** allows for the user of the client computer **106** to input data describing usage patterns of PPE for a particular client. Such data is then synchronized with the server **102** for the generation of a product usage analysis report.

[0036] The client assessment software **130** comprises a data entry module **138**, a client synchronization module **140**, a pre-assessment module **142**, a survey module **144**, a floor plan module **146**, and a benchmark module **148**. The data entry module **138** comprises a series of forms and data entry fields for allowing the input of client product usage data. In some embodiments, the client product usage data is manually input by a user, but one of ordinary skill in the art would recognize that such data could be automatically transferred or generated from client records, invoices, and the like.

[0037] The client synchronization module **140** sends and receives data to and from the server **102**. In some embodiments, the client synchronization module may include PERVASYNC® software modules. In some embodiments, the client synchronization module **140** manages a wireless network stack executing on the client computer **106**. In some embodiments, the client synchronization module **140** maintains records of newly input data to the client computer **106** and performs synchronization functions when connected to the server **102**. One of ordinary skill in the art would recognize a variety of wired and wireless method of synchronizing product usage data from the client computer **106** to the server **102**.

[0038] The client computer **106** further comprises a pre-assessment module **142**, a survey module **144**, a floor plan module **146**, and a benchmark module **148**. Each of these modules allows for the entry of specific types of data associated with product usage. These data types are described more fully with respect to FIGS. **2-5**.

[0039] FIG. **2** is a flow diagram depicting a method **200** for optimizing product usage. The method **200** represents an embodiment of an implementation of the server assessment **126** operating in combination with the client assessment software **118**. The method **200** begins at step **202** and proceeds to step **204**.

[0040] At step **204**, the method **200** stores corporate information. Corporate information comprises hierarchical levels of a corporate organization and PPE needs associated with each level. The method **200** then proceeds to step **206**. At step **206**, method **200** receives benchmark data describing a current product usage for each level of the corporate organization. Benchmark data describes information about the current equipment usage practices of the customer, as they exist at the start of the assessment. Benchmark data may relate to functions such as cost performance, injury reduction, SKU reduction, controls information, training

information, best practices benchmarks, and the like. Benchmark data includes current cost spending on PPE, injury statistics, and a number of SKU's currently used, training practices, PPE control procedures, and levels of waste at the start of a survey. This information will become the benchmark against which potential savings can be measured as well as a way to track actual improvement going forward. The method **200** then proceeds to step **208**. At step **208**, the method **200** performs an analysis based on corporate information and benchmark data to determine optimal usage for a plurality of products. The analysis compares the benchmark data to the PPE needs of the application and looks for areas of improvement. Optimum usage is not simply finding the best PPE fit for an application; the assessment analyzes the impact of cost savings from injury reduction due to the recommended PPE use, improved PPE control procedures, decreased levels of waste, improved training procedures, in addition to the impact of the new price point of the recommended PPE. The optimum usage may incorporate a more appropriate PPE at a higher price point that results in an ultimate savings to the client due to savings from reduced injuries or better control procedures that extend the life of the PPE.

[0041] In some embodiments, each application has a plurality of characteristics and each characteristic has a rating of the level required for that characteristic. Although five characteristics are discussed here, those skilled in the art will appreciate the characteristics used are not limited to those embodiments discussed here. Further, although a rating system of 0-10 is discussed here, those skilled in the art will appreciate the various rating systems which can be used to rate characteristics. In one embodiment, the rating system is a number rating of 0-10. In this embodiment, for example, an application requires the following levels of each characteristic listed:

Chemical resistance	8
Cut resistance	4
Crush resistance	7
Flexibility	2
Flammability	1

Each product has a rating for the same plurality of characteristics as the application and each characteristic has a rating of the level provided for that characteristic. In this embodiment, for example, Product A, Product B, and Product C provide the following levels of each characteristic listed:

	Product A	Product B	Product C
Chemical resistance	7	9	2
Cut resistance	1	5	4
Crush resistance	9	1	7
Flexibility	7	7	3
Flammability	5	8	1

[0042] The application profile is compared to the profile for the products. None is a perfect fit, but the application may specify which characteristics are higher priorities. For example, if chemical resistance and crush resistance are the highest priorities, Product A would be selected. If chemical resistance and cut resistance are the highest priorities, Product B would be selected. Even though Product C shares the same ratings for most characteristics, it would still not be selected because the highest priority, namely, chemical resistance, is not sufficient in Product C.

[0043] The product selection is then compared to benchmark data in order to ensure the recommendation will result in an improvement, taking into consideration both corporate and benchmark data, such as a number of employees at the application, a tested lifespan of the product, the impact on injury or SKU reduction and the like. The method **200** proceeds to step **210**. At step **210**, the method **200** generates a product usage recommendation based on the determined optimum usage. The method **200** proceeds to step **212** and ends.

[0044] FIG. **3** is a flow diagram depicting a method **300** for computing optimal product usage. The method **300** represents an embodiment of an implementation of the server assessment software **126** operating in combination with the client assessment software **118**. The method **300** begins at step **302** and proceeds to step **304**.

[0045] At step **304**, the method **300** allows for a user to log in to a system. In some embodiments, a particular user login identifier is associated with various permission levels for the system. For example, a user login may be classified as a "superuser" or "administrator" login, allowing them to add or modify permissions for other users. A user login may be associated with specific equipment analysis reports or site surveys. For example, a customer may be provided with a user login that only allows them to perform operations related to data about their own facilities within the system. In some embodiments, a user may have access to a subset of data for a particular customer, or data for multiple customers. For example, a sales employee may have access to the data for each customer he supplies, or a sales employee may only supply a single facility for a customer with multiple facilities, and thus may have access to only the single facility data.

[0046] After performing a login operation, the method **300** proceeds to step **306**. At step **306**, the user selects from a plurality of tasks, including data synchronization at step **308**, data entry at step **316**, or requesting a report at step **328**. If the user chooses to synchronize data, the method **300** proceeds to step **308**. If the user chooses to enter data, the method **300** proceeds to step **316**. If the user chooses to request a report, the method **300** proceeds to step **328**.

[0047] At step **308**, the client computer **106** synchronizes data with the server **102**. As described above with respect to FIG. **1**, the synchronization process may be accomplished via a multitude of methods as known in the art, including wired and wireless network communications, removable storage transfer, local area connections such as BLUETOOTH, and the like. As the client computer **106** sends data to the server **102**, the method **300** proceeds to step **310**. At step **310**, the server **102** performs synchronization operations with the client via the process described above and with respect to FIG. **1**. The method **300** proceeds to step **312** and continues synchronization as needed. After synchronization is complete, the method **300** proceeds to step **314** and ends.

[0048] If the user selects a data entry operation at step **306**, the method **300** proceeds to step **316**. At step **316**, the method **300** allows for the entry of pre-assessment data. Examples of pre-assessment data include entering customer information into the system to create a survey, data that describes a floor plan for which benchmark and assessment

data must be entered, and the like. After entering the pre-assessment data, the method **300** proceeds to step **318**.

[0049] At step **318**, the method **300** allows for the entry of benchmark data. As described above, benchmark data describes information about the current equipment usage practices of the customer at the time of the survey. Benchmark data may relate to functions such as cost performance, injury reduction, SKU reduction, controls information, training information, best practices benchmarks, and the like. Specific benchmark data is described further with respect to FIGS. **7**A-7E.

[0050] At step **320**, the user performs a survey of the customer's facility or facilities. A survey represents a series of modules that generate comparisons between the benchmark data defined at step **318** and possible cost savings measures. The modules are described in further detail with respect to FIG. **6** and FIGS. **9-14**. After creating the survey, the method **300** proceeds to step **322**.

[0051] At step **322**, the method **300** performs an assessment. The assessment represents the changes that might be made from the current benchmark data gathered at step **318** within the modules defined by the survey at step **320**. Data from the assessment is then sent to the server **102** (such as via the synchronization process at step **308**), and the method **300** proceeds to step **324**.

[0052] At step **324**, the method **300** performs data processing to generate a set of intermediate metrics **125** that are used to generate the product usage analysis report. After processing the data within the assessment, the method **300** proceeds to step **326**.

[0053] If the user selects the option to request a report at step **306**, the method **300** proceeds to step **328**. At step **328**, the client sends a request to the server **102** to generate a product usage analysis report. A report produced in this manner is generated from previously cached or supplied data. The method **300** then proceeds to step **326** where the report is created by the server **102**.

[0054] At step **326**, the method **300** generates a product usage analysis report based upon the performed assessment while utilizing product data **122** and application data **124**. After generating the report, the method **300** proceeds to step **330**.

[0055] At step **330**, the server **102** sends the report to the client computer **106**. While the exemplary method describes sending the report after generating the report, one of ordinary skill in the art would recognize that such an invention also allows for storing the report on the server **102**. The report could then be transmitted to a separate client computer, accessed directly on the server, transferred to removable storage, printed out, and the like. As the report is sent, the method **200** proceeds to step **332**. At step **332**, the client computer **106** receives the report. The client computer **106** then displays the report at step **324**. The method **300** ends at step **336**.

[0056] FIG. **4** is a flow diagram depicting a method **400** of entering pre-assessment data in accordance with embodiments of the present invention. The method **400** represents one embodiment of an implementation of the pre-assessment module **142**. The method **400** begins at step **402** and proceeds to block **404**, where a customer is defined. In block **404**, at step **412** a determination is performed to decide if the customer is new or existing. If the customer exists within the data saved to the client computer **106** or the server **102**, the method **400** proceeds to step **414**. If the customer is new, the method **400** proceeds to step **416**.

[0057] At step **414**, the method **400** loads the existing information regarding the customer. The method **400** then proceeds to step **416**.

[0058] At step **416**, the method **400** prompts for entry of information describing the customer. If the customer was an existing customer, this information may already be populated, and the user may edit it. Customer information may include a company name, an address, contact information such as a telephone number and/or email address, an identified point of contact, a field of industry, prior invoices with the customer, login names, access rights assigned to the login names, and/or the like. These access rights determine which types of data are viewable to the customer. After the customer information is entered, the method **400** proceeds to block **406**.

[0059] Block **406** is broadly related to the definition of a specific floor plan for a particular assessment. The block begins at step **418** when it determines whether the floor plan is a new floor plan, or an existing one. If the floor plan is new, the method **400** proceeds to step **422**. If the floor plan exists, the method **400** proceeds to step **420**.

[0060] At step **420**, the method **400** accesses information that was previously entered for the floor plan. After accessing the previously saved information, the method **400** proceeds to step **422**. At step **422**, the method **400** provides for entry of floor plan information, such as information describing the corporation, the division of the corporation, the region, the plant, the department, the area, the line, and the product applications of the given floor plan. A client may provide floor plan information during pre-assessment or use a pre-defined template similar to the location that will be assessed. The hierarchical design of the floor plan structure is described further with respect to FIG. **5**.

[0061] After entering the floor plan information at step **422**, the method **400** proceeds to step **408**. At step **408**, the method **400** creates the floor plan based upon the information entered in blocks **404** and **406**. After creating the floor plan, the method **400** ends at step **410**.

[0062] FIG. **5** depicts a block diagram of a floor plan structure **500** as referenced with respect block **406** of FIG. **4**. The floor plan structure **500** provides a container and data structure for gathered assessment data. The floor plan structure **500** is typically presented as a hierarchical tree structure. At the top level of the tree is a set of corporate information **502**. The corporate information **502** describes assessment information that is relevant to the entire corporation for which the assessment is being performed. The corporate information **502** may further link to one or more sets of division information **504**. The division information **504** contains information that describes a given division within the corporation. A division may include a given product line, a specific wholly owned subsidiary, or any other method for dividing up the corporation. A division is further divided into regions. Regions are typically defined geographically, but one of ordinary skill in the art would recognize that a division might also be divided based upon other criteria such as healthcare network, and the like. Data describing each region within the division is organized into a set of region information **506**.

[0063] Each region includes one or more plants. Plants are defined as individual locations within the region, such as industrial, research, or fabrication facilities. A plant may be

associated with a specific activity. If the products are healthcare related, such as examination or surgical gloves, the plants may include hospitals, clinics or doctors' offices. Information describing the plants within the region is contained within one or more sets of plant information **508**. Within each plant are one or more departments. The plant information **508** is thus further divided into multiple sets of department information **510**. Each department may include multiple areas described by area information **512**, and each area of the department may include multiple lines, described by product information **514**. A specific line has one or more product applications, which are defined in a set of product application information **516**. Each application is a different use for a PPE. While there are a number of levels available in a floor plan, a user will only work with the levels that are relevant to the site being assessed. A simple application assessment may only require three levels, for example, a corporate level, a department and applications within the department.

[0064] Each hierarchical level is defined during the pre-assessment stage as described with respect to FIG. **4**. The assessment data for each element of the floor plan is then obtained during the benchmarking and assessment processes described with respect to FIG. **3**. In other words, the pre-assessment process defines the container of the floor plan structure, while the assessment process defines the data within the container. Each hierarchical level of the tree may have multiple elements, as described with reference to element **518**, representing the next element of the tree at the same level.

[0065] FIG. **6** depicts a flow diagram describing a method **600** for entering benchmark data in accordance with embodiments of the present invention. The method **600** represents one embodiment of an implementation of a benchmark module **148**. The method **600** would typically be employed by the client device **106** described with respect to FIG. **1** to gather data for transmittal to the server **102** for generating the equipment usage analysis reports. The method **600** begins at step **602** and proceeds to step **604**. At step **604**, the method **600** allows the user to select an organization level, such as the various hierarchical levels of the floor plan structure described with respect to FIG. **5**. After selecting the organization level, the method **600** proceeds to step **606**. At step **606**, a benchmark category is selected. Depending upon which benchmark category is selected, the method **600** proceeds to step **608**, step **610**, step **612**, step **614**, step **616**, step **617**, or step **618**.

[0066] At step **608**, if cost performance data was selected at step **606**, the method **600** allows for the entry of data about currently used products. Current usage information includes each product used, the purchase price, the number of sizes used, the cost to launder, inventory on hand, and the like. Current usage information is used to calculate the amount spent annually per PPE per man hour, the number of gloves used by employees per day, total cost/volume per department, etc. These metrics may be used for identification of savings that would result from decreasing inventory needs, laundering of products, increasing durability of replacement products, decreasing cost of replacement products, and the like. For example, the cost performance data indicates which products are being currently laundered or merely disposed. As another example, the cost performance data indicates the savings resulting from production standardization, such as the elimination of duplicate products. The data processing module **132** uses the cost performance data to generate a cost performance analysis by the method described with respect to FIG. **9**. After allowing entry of cost performance data, the method ends at step **622**.

[0067] At step **610**, the method **600** allows for the entry of injury reduction data. Injury reduction data includes types of injuries recorded in a given time frame. Injury details include the body part affected, such as an arm, hand, or finger and the type of injury, such as a laceration, amputation, or abrasion. The number of injuries is recorded, in addition to the costs of the injuries, the total work days lost or restricted, and the like. The data processing module **132** uses the injury reduction data to generate an injury reduction analysis by the method described with respect to FIG. **10**. After allowing entry of injury reduction data, the method **600** ends at step **622**.

[0068] At step **612**, the method **600** allows for the entry of SKU reduction data. SKU reduction data includes data describing the products inventory currently used by the customer. SKU reduction data includes the amount of on-hand inventory and the costs associated with carrying that inventory. This includes the cost of storing and maintaining the inventory, a cost based on the current capital interest rate associated with purchasing the on-hand inventory, the current number in days of inventory in stock at the plant. In some embodiments, the SKU reduction data overlaps with the cost performance data. The data processing module **132** uses the SKU reduction data to generate a SKU reduction analysis by the method described with respect to FIG. **11**. After allowing entry of SKU reduction data, the method **600** ends at step **622**.

[0069] At step **614**, the method **600** allows for the entry of controls information. Controls information data is data regarding management of the lifecycle of the PPE while it is in the plant. This includes data describing practices the company currently uses to perform dispensing, usage, laundering, recycling, and disposal procedures. The data processing module **132** uses the controls information data to generate a controls analysis by the method described with respect to FIG. **12**. After allowing entry of controls information data, the method **600** ends at step **622**.

[0070] At step **616**, the method **600** allows for the entry of training information. Training information includes information describing the company's current practices that educate employees on the proper selection, use and disposal of products. The data processing module **132** uses the training information to generate a training analysis by the method described with respect to FIG. **13**. After allowing entry of training information, the method **600** ends at step **622**.

[0071] At step **617**, the method **600** allows for entry of production waste information. Production waste information includes information describing the company's areas of potential waste. These include defects to the company's manufactured products due to a less than optimal choice of PPE in terms of fit, comfort, and safety and wear life. When one line is producing a widget faster than the next line can use it, a cost of extra floor space used results due to the over production. The transportation costs associated with obtaining and disposing of PPE products is entered. This involves the downtime associate with an employee who needs to replace a PPE. For example, if a glove has a lifespan of four hours, an employee needs to replace that glove during working hours. The time required for the employee to stop

working, travel to and from the glove dispensing and disposal area may be entered. Also, there are costs associated with waiting in line for PPE dispensing, costs associated with floor space taken up by PPE product inventory, a number of ergonomic health and safety incidents, and the average compensable time for donning/doffing per worker. The data processing module **132** uses the production waste information to generate a production waste analysis by the method described with respect to FIG. **14**. After allowing entry of production waste information, the method **600** ends at step **622**.

[0072] At step **618**, the method **600** allows for the entry of other information. Other information may include information that does not directly relate to a specific module, but that is still relevant to the product usage analysis. For example, the other information may indicate which issue types are affecting current product usage, such as, wear and tear, contamination, infection, and/or the like. The other information may also include data related to effectiveness of currently used products, time and motion efficiency and/or supply chain issues. The other information may also include data associated with OSHA (Occupational Safety and Health Administration) regulatory compliance. After the other information has been entered, the method **600** ends at step **622**.

[0073] FIGS. **7**A-**7**E depict exemplary data tables that contain entered information used to generate product usage analysis reports in accordance with embodiments of the invention. Tables **700** and **708** include data describing particular PPE products used by the company, various factors about the products, and company practices for management of the products. Examples of factors about the products are the average lifespan of a PPE, the frequency and associated costs, if any, of laundering the PPE, a number of sizes used, and the like. For example, the average lifespan of a product is determined based on observations at a corporate facility and a manufacturer's experience for how long the product should last. The value may be benchmarked with user testing. These factors are examples of different data regarding products that may be stored. However, it will be understood by those skilled in the art that many forms of information can be used. Such data is used to generate cost performance reports, SKU reduction reports, and controls information reports in accordance with the methods described with respect to FIG. **9**, FIG. **11**, and FIG. **12**, respectively.

[0074] Table **702** and table **704** include data describing the various injuries that have occurred at the site being surveyed. This injury data is used to generate injury analysis reports in accordance with the method described with respect to FIG. **10**. For healthcare related products, these tables may be populated with an injury rate and/or a hospital acquired infection rate for medical personnel and/or patients.

[0075] Table **706** as shown in FIG. **7**D includes data describing training practices at the site being surveyed. The training data is used for generating training analysis reports in accordance with the method described with respect to FIG. **13**.

[0076] FIG. **8** depicts a block diagram of an exemplary product analysis report **800** generated in accordance with embodiments of the present invention. The product analysis report **800** is created after the various analysis modules have produced a set of intermediate metrics such as the intermediate metrics **125** described with respect to FIG. **1**. The methods by which the analysis modules generate this data are described further with respect to FIGS. **9**-**14**. The product analysis report **800** comprises a best practices assessment **802**, a financial impact **804**, a product usage overview **806**, an injury (or infection) analysis **808**, an implementation plan **810**, and an appendix **812**.

[0077] The best practices assessment **802** provides a broad overview of the current compliance level with best practices associated with each analysis module. For example, the best practices assessment may give the company (i.e., a company plant) a rating for their current SKU reduction level—in other words, is the company using the optimal number of different products to satisfy their needs. The closer the company is to this optimal number, the higher the rating. Similar best practices scores are provided for each module selected for the survey. In some embodiments, the rating is computed by averaging the best practices scores in the best practices assessment as explained further below. In some embodiments, the best practices assessment may also allow the company to assess their own performance to compare with the score generated by the analysis modules.

[0078] During the best practices assessment **802**, each of the assessment modules has a series of corresponding best practices. Each best practice score indicates a frequency at which each best practice is implemented. The best practice score is a numeric value that ranges from a fixed value indicating never and a fixed value indicating always. For example, the best practice score may be one (1) denoting no observed implementation, two (2) denoting occasionally implementation, three (3) denoting usually implemented and four (4) denoting always implement. In such an example, the best practices assessment **802** may be performed as followed, which the average rating is computed to be 1.8:

Best Practice	Best Practice Score
Calculate cost/volume by department	2
Calculate annual glove spend on man hour basis	1
Benchmark number of gloves used by employee per day	1
Conduct semi-annular job assessment to match glove performance to critical hazards of the job	1

[0079] The product analysis report **800** further comprises a financial impact **804**. The financial impact **804** describes the potential cost savings from adopting the best practices as calculated by the analysis modules selected to perform the survey. The financial impact **804** may include an overall cost savings and a breakdown for each analysis module. For example, the financial impact **804** may state that a cost savings of $314,000 is possible. Of that $314,000, $193,000 may be from decreased injury risk associated with using different PPE products, $47,000 may be associated with using different laundering procedures to clean and reuse PPE products, etc.

[0080] The product analysis report **800** further comprises a product usage overview **806**. The product usage overview **806** describes the PPE products currently used by the company, the volume in which they are used, and a proposed alternate set of PPE products.

[0081] The product analysis report **800** may also comprise an injury analysis **808** if the injury module was selected for the survey. The injury analysis **808** describes the number of

injuries reported of a particular type, and estimates the number of injuries that would occur using the alternate equipment proposed in the product usage overview **806**.

[0082] The product analysis report **800** also includes an implementation plan **810**. The implementation plan **810** describes a proposed time table for implementing the changes described in the financial impact **804** to switch over to the alternate set of products described in the product usage overview **806**.

[0083] The product analysis report **800** also includes an appendix **812**. The appendix **812** comprises one or more application summaries **814**, one or more product references **716**, and one or more evaluation responses **818**. The application summaries **814** are a description of the various tasks for which the proposed PPE is used, the current product used for the task, and the proposed new product for the task. The product references **816** are detailed product pages describing the characteristics of the proposed replacement products proposed in the product usage overview **806**. The evaluation responses **818** are responses to evaluation requests filled out by the company, such as by company employees, as to the quality and uses of the company's current types of PPE.

[0084] FIGS. **9-14** describe methods by which individual analysis modules may generate intermediate metrics **125** for use by the data processing module **132** to generate the report **127**. While the flow diagrams are depicted as discrete methods for generating separate analyses, one of ordinary skill in the art would recognize that multiple factors could be used to generate an optimum solution of product replacements. For example, the most cost effective product might also represent an increased risk of injury, such that the next most cost effective product would represent an overall savings. In such case, the data processing module **132** might recommend the less cost effective product to generate the most overall savings. This process is described further with respect to FIG. **15**.

[0085] FIG. **9** depicts a method **900** for generating a cost performance analysis report in accordance with embodiments of the present invention. The method **900** represents one embodiment of an implementation of the cost performance module **150**. In some embodiments, the method **900** may be performed by the cost performance module **150** as described with respect to FIG. **1**. The method **900** begins at step **902** and proceeds to step **904**. At step **904**, the method **900** examines the applications that are associated with the particular survey. The method **900** determines the minimum performance characteristics to perform the applications, and which applications have which minimum characteristics. The method **900** then proceeds to step **906**.

[0086] At step **906**, the method **900** determines the most cost effective PPE solution to meet the needs of the applications as determined at step **904**. In some embodiments, cost performance module **150** examines performance characteristics associated with each available product. Using the pre-assessment data entered in FIG. **4** which describes current task requirements, the cost performance module **150** compares these requirements with the available product performance characteristics identified in the product data and application data described with respect to FIG. **1** to identify one or more best performing products. In order to determine the most cost effective solution, the assessment analyzes the annual expenditure per PPE per man hour, the number of gloves used by employees per day, as well as costs to launder the PPE and maintain the inventory of the PPE. The most cost effective product solution may raise product costs, but those may be offset by certain controls, such as laundering, recycling, repair and the like. A more expensive product that is better at preventing injuries can replaces a current product and result in an overall cost savings. The method **900** ends at step **908**.

[0087] FIG. **10** depicts a method **1000** for generating an injury reduction analysis report in accordance with embodiments of the present invention. The method **1000** represents one embodiment of an implementation of the injury module **152**. In some embodiments, the method **1000** may be performed by the injury module **152** as described with respect to FIG. **1**. The method **1000** begins at step **1002** and proceeds to step **1004**. At step **1000**, the method **1000** examines the reported injuries associated with the current survey. Injury details such as the body part affected, such as an arm, hand, or finger, and the type of injury, such as a laceration, amputation, or abrasion can be used to determine which injuries were associated with a failure of a particular product. For example, a given injury might occur because a user finds the product uncomfortable and thus removed it to perform a dangerous task, or an injury might have occurred because the product was inadequate for the particular task. Direct injury costs, such as the cost of medical treatment to treat the injury and indirect injury costs, such as time lost in productivity for the injured employee are included in the assessment. The method **1000** then proceeds to step **1006**. At step **1006**, the method **1000** determines an estimate of a number of injuries that could be prevented if different product solutions were employed. In some embodiments, the injury prevention estimates are based on task type and associated risks and injury causes and severity in view of the performance capabilities of a new product. For example, a PPE use that results in the need for a $0.08 bandage to cover a scratched finger in 1% of employees would not result in a recommendation for a more expensive glove because the savings associated with the injury reduction would not be cost effective based on the severity and expense of the injuries addressed. However, when the injury is more severe, such as a crush injury resulting in broken fingers, a more expensive glove may be cost effective because the increase in the cost of the glove is offset by the decrease in injury costs resulting from a more appropriate PPE. The method **1000** uses database queries to match injury causing tasks with appropriate injury prevention products. After determining the injury prevention estimates for the various product solutions, the method **1000** ends at step **1008**.

[0088] FIG. **11** depicts a method **1100** for generating a SKU reduction analysis report in accordance with embodiments of the present invention. The method **1100** represents one embodiment of an implementation of the SKU reduction module **154**. In some embodiments, the method **1100** may be performed by the SKU reduction module **154** as described with respect to FIG. **1**. The method **1100** begins at step **1102** and proceeds to step **1104**. At step **1104**, the method **1100** determines the minimum PPE requirements for the applications associated with the survey, such as the minimum strength, flexibility, safety ratings, and the like associated with the various tasks performed at the facility.

[0089] The method **1100** then proceeds to step **1106**. At step **1106**, the method **1100** determines a minimum number of different types of products needed to satisfy all requirements of the various applications. For example, this determination may include using the same type of product for two

similar tasks, even if one task has slightly lesser requirements, as a reduction in the number of stocked product SKUs can result in a cost savings even if a more expensive product is used. After performing a SKU reduction analysis, the method **1100** ends at step **1008**. SKU reduction is divided into savings components. First, the method **1000** determines key performance indicators (KPI) for reducing a number of SKUs. By examining minimum and maximum inventory levels, the method **1100** computes carrying costs and costs for purchasing product on credit. Reducing an amount of products that the customer needs to store reduces inventory levels and capital expenses tied up in such inventory.

[0090] FIG. **12** depicts a method **1200** for generating a controls information analysis report in accordance with embodiments of the present invention. The method **1200** represents one embodiment of an implementation of the controls module **156**. In some embodiments, the method **1200** may be performed by the controls module **156** as described with respect to FIG. **1**. The method **1200** begins at step **1202** and proceeds to step **1204**. At step **1204**, the method **1200** examines current controls practices at the facility. Control practices describe the management of the lifecycle of the PPE while it is in the plant. For example, controls practices may include the method by which products are dispensed to employees and the time required for dispensing, whether or not product is laundered such that it can be reused, whether a discarded product is recycled, the type of disposal techniques that are followed, and the like.

[0091] After determining the current controls practices, the method proceeds to step **1206**. At step **1206**, the method **1200** determines the effect of various alterations on the site controls practices, and the different options presented by alternate PPE. For example, a given alternate product may be launderable or repairable where the original was not, resulting in a cost savings due to the opportunity to reuse the product. The method **1206** may also examine the effect of alternate laundering, repairing, recycling, disposal and distribution techniques. For example, the controls module **156** receives user input indicating a number of cycles for laundering a product and performs financial computations to determine potential cost savings. As another example, the controls module **156** defines an employee control in which a current product is returned to a supervisor before receiving a new product and determines a ten (10) percent decrease in usage. If the current product is a glove of which a hundred pairs are purchased at two (2) dollars apiece, the yearly cost would be two hundred dollars. By reducing the usage by ten percent, ten gloves would not need to be purchased resulting in a total savings of twenty dollars per year. When alternate controls practices have been analyzed, the method **1200** proceeds to step **1208** and ends.

[0092] FIG. **13** depicts a method **1300** for generating a training practices analysis report in accordance with embodiments of the present invention. The method **1300** represents one embodiment of an implementation of the training module **158**. In some embodiments, the method **1300** may be performed by the training module **158** as described with respect to FIG. **1**. The method **1300** begins at step **1302** and proceeds to step **1304**. At step **1304**, the method **1300** analyzes the set of current training practices employed by the company with respect to the current product in use as entered with regard to FIG. **6**. The method **1300** then proceeds to step **1306**. At step **1306**, the method **1300** determines the impact of changes to the site training practices. When the alternate training practices have been analyzed, the method **1300** proceeds to step **1308** and ends.

[0093] FIG. **14** depicts a method **1400** for generating a production waste analysis report in accordance with embodiments of the present invention. The method **1400** represents one embodiment of an implementation of the production waste module **159**. In some embodiments, the method **1400** may be performed by the production waste module **159** as described with respect to FIG. **1**. The method **1400** begins at step **1402** and proceeds to step **1404**. At step **1404**, the method **1400** examines current production waste protocols at the facility as entered with regard to FIG. **6**. Production waste includes defects to the facility's manufactured products caused by a less than optimal choice of PPE in terms of fit for the task. Additional production waste includes over production, transportation costs, wait time, floor space taken up by PPE product inventory, the number of ergonomic health and safety incidents, and the average compensable time for donning/doffing per worker. The method **1400** then proceeds to step **1406**. At step **1406**, the method **1400** determines the impact that changes in the PPE selection would have on production waste. This can include changes in protocols for donning/doffing, protocols for replenishment of gloves, all protocols for disposal of gloves, all of which can minimize worker downtime. When the alternate production waste protocols have been analyzed, the method **1400** proceeds to step **1408** and ends.

[0094] FIG. **15** depicts a method **1500** for generating a product analysis report in accordance with embodiments of the present invention. The method **1300** represents one embodiment of an implementation of the optimization module **160**. In some embodiments, the method **1500** may be performed by the optimization module **160** as described with respect to FIG. **1**. The method **1500** receives as input data from one or more of the modules performing the methods as described in FIGS. **9-13**. One of ordinary skill in the art would recognize that all of the modules described in FIGS. **9-13** could be used to generate the product analysis report, or only a subset of the modules. In some embodiments, the data produced by these methods is presented as individual reports which are presented separately within the product analysis report. In some embodiments, the data is received as a set of intermediate metrics. The present exemplary embodiment of the method **1500** assumes that said data is provided as said intermediate metrics.

[0095] The method **1500** begins at step **1502** and proceeds to step **1504**. At step **1504**, the method **1500** receives a set of input information from one or more analysis modules. After receiving the input information, the method **1500** proceeds to step **1506**. At step **1506**, the method **1500** determines an optimal product configuration from the input information received at step **1504**. For example, the method **1500** may examine a SKU reduction analysis to determine that the needs of the facility can be combined into various combinations of products to limit the overall number of SKUs. These combinations can then be compared against an injury reduction report for the various SKUs to determine the overall cost savings in both injury and SKU reduction for a given combination. Such a comparison indicates the effect of the SKU reduction on injury reduction. These various combinations may also be cross-checked against other analysis module data, such as the cost performance analysis, controls information analysis and/or training practices

analysis. For example, such a cross-check may determine that a low SKU reduction exposes certain tasks to risks while a high SKU reduction increases expenses or causes training confusion. One of ordinary skill in the art would recognize that various methods of determining an optimal solution could be performed based upon the available information and computing power.

[0096] After determining an optimal product configuration, the method **1500** proceeds to step **1508**. At step **1508**, the method **1500** generates an overall cost savings information for the best practices employed by the chosen optimal product configuration. The overall cost savings information and the chosen optimal product configuration are then used to generate a product usage analysis report **700**.

[0097] The methods described herein may also be applied to the medical field. Common hazards in a surgical environment include bloodborne pathogens, latex allergies, laser hazards, hazardous chemicals, equipment hazards, radiation exposure, tuberculosis, and the like. PPE in the medical field include medical gloves, masks, eyewear, gowns and drapes, and other perisurgical devices.

[0098] Calculating an optimal usage of medical PPE incorporates factors used for calculating an optimal usage in the industrial PPE field, but also may incorporate additional safety parameters in the optimal usage calculation, such as patient and staff injuries as well as hospital acquired infections.

[0099] The methods described herein may be implemented in software, hardware, or a combination thereof, in different embodiments. In addition, the order of methods may be changed, and various elements may be added, reordered, combined, omitted, modified, etc. All examples described herein are presented in a non-limiting manner. Various modifications and changes may be made as would be obvious to a person skilled in the art having benefit of this disclosure. Realizations in accordance with embodiments have been described in the context of particular embodiments. These embodiments are meant to be illustrative and not limiting. Many variations, modifications, additions, and improvements are possible. Accordingly, plural instances may be provided for components described herein as a single instance. Boundaries between various components, operations and data stores are somewhat arbitrary, and particular operations are illustrated in the context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within the scope of claims that follow. Finally, structures and functionality presented as discrete components in the example configurations may be implemented as a combined structure or component. These and other variations, modifications, additions, and improvements may fall within the scope of embodiments as defined in the claims that follow.

[0100] While the foregoing is directed to embodiments of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

What is claimed is:

1. A system for computing personal protective equipment (PPE) recommendations, comprising:

a plurality of client computers, where each client computer in the plurality of client computers, uses a processor, for receiving and storing corporate information of a corporate organization and PPE needs associated with the corporate organization; and for receiving and storing a plurality of benchmark data describing a current PPE usage for at least one application of the PPE within the corporate organization;

a server, remotely located from the plurality of client computers and connected to the plurality of client computers via a network, the server comprising a processor and a memory coupled to the processor, the memory having stored therein program instructions executable by the processor to configure the server to:

identify a selected PPE by performing an analysis based on the corporate information and the benchmark data wherein the analysis compares characteristics of a plurality of PPE against PPE characteristics required for the at least one application for determining areas of improvement wherein the selected PPE improves the benchmark data by comparing the characteristics of the selected PPE to the benchmark data; and

generate a PPE recommendation based on the selected PPE that improves the benchmark data, wherein the PPE recommendation includes a PPE configuration for the at least one application based on the determined areas of improvement.

2. The system of claim **1**, wherein the PPE characteristics required for the at least one application are given a priority ranking of importance via at least one of the plurality of client computers and the analysis takes into account the priority ranking of the PPE characteristics required for the at least one application when selecting a PPE.

3. The system of claim **1**, wherein the corporate information and benchmark data is synchronized between the plurality of client computers and the server.

4. The system of claim **1**, wherein the benchmark data comprises at least one of cost performance data, an injury reduction data, SKU reduction data, a training information or production waste data.

5. The system of claim **1**, wherein the corporate information is organized in hierarchical levels and the hierarchical levels include at least one of a corporation, a division, a region, a plant, a department, an area, a line, or a product application.

6. The system of claim **1**, further comprising at least one display device for presenting a report including the selected PPE and at least one benefit associated with the selection of the selected PPE.

7. The system of claim **1**, wherein the server communicates the PPE recommendation to at least one of the plurality of client computers for display.

8. The system of claim **1**, wherein the plurality of client computers comprise one or more of desktop computers, laptop computers, notebook computers, smart phones, or tablet computers.

9. An apparatus for computing personal protective equipment (PPE) recommendations, comprising:

a memory to store information and program instructions;

a processor, coupled to the memory, to execute the program instructions to configure the apparatus to:

identify a selected PPE by performing an analysis based on corporate information of a corporate organization and PPE needs associated with the corporate organization and benchmark data describing a current PPE usage for at least one application of the PPE within the corporate organization wherein the analy-

sis compares characteristics of a plurality of PPE against PPE characteristics required for the at least one application for determining areas of improvement wherein the selected PPE improves the benchmark data by comparing the characteristics of the selected PPE to the benchmark data; and

generate a PPE recommendation based on the selected PPE that improves the benchmark data, wherein the PPE recommendation includes a PPE configuration for the at least one application based on the determined areas of improvement.

10. The apparatus of claim **9**, further comprising at least one display device for presenting a report including the selected PPE.

11. The apparatus of claim **10**, where the report further includes at least one benefit associated with the selection of the selected PPE

12. The apparatus of claim **9**, wherein the PPE characteristics required for the at least one application are ranked in an order of importance and the analysis takes into account the ranking of the PPE characteristics required for the at least one application when selecting a PPE.

13. The apparatus of claim **9**, wherein the benchmark data comprises at least one of cost performance data, an injury reduction data, SKU reduction data, a training information or production waste data.

14. The apparatus of claim **9**, wherein the corporate information is organized in hierarchical levels and the hierarchical levels include at least one of a corporation, a division, a region, a plant, a department, an area, a line, or a product application.

15. The apparatus of claim **9**, wherein the benchmark data further comprises entry of at least one of an injury reduction data, inventory control information, or a training information.

16. The apparatus of claim **9**, wherein the analysis comprises at least one of a financial impact analysis or a PPE usage overview analysis.

17. A method for computing personal protective equipment (PPE) recommendations, comprising:

identifying, at a server, a selected PPE by performing an analysis based on corporate information of a corporate organization and PPE needs associated with the corporate organization and benchmark data describing a current PPE usage for at least one application of the PPE within the corporate organization and a priority ranking of importance for a plurality of characteristics required for the at least one application wherein the analysis compares characteristics of a plurality of PPE against the ranked characteristics for the at least one application for determining areas of improvement wherein the selected PPE improves the benchmark data by comparing the characteristics of the selected PPE to the benchmark data; and

generating a PPE recommendation based on the selected PPE that improves the benchmark data, wherein the PPE recommendation includes a PPE configuration for the at least one application based on the determined areas of improvement.

18. The method of claim **17**, further comprising ranking the PPE characteristics required for the at least one application in an order of importance and taking into account the priority ranking of the PPE characteristics required for the at least one application when selecting a PPE.

19. The method of claim **18**, further comprising displaying a report including the selected PPE.

20. The method of claim **18**, further comprising organizing the corporate information in hierarchical levels and the hierarchical levels include at least one of a corporation, a division, a region, a plant, a department, an area, a line, or a product application.

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