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Using Risk Based Decision Making to Select Personal Protective Equipment for Oil Spill Responders

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ABSTRACT 300237:

Typically, personal protective equipment (PPE) is the primary control measure employed during emergency response operations. PPE and administrative controls rise to the forefront of oil spill response activities due to inherent delays and feasibility issues involved in the implementation of effective engineering controls. Response organizations, possibly due to a failure to assess the hazards appropriately, overprescribe PPE in an attempt to ensure both compliance and protection; however, this approach may actually increase the risk of injury or illness. Choosing and implementing PPE as a response control measure is never a “one-size-fits-all” solution. The proper selection of PPE requires a risk assessment that takes into account the responders, working conditions, tasks and their associated hazards. Moreover, as the work and conditions change, a reassessment is necessary.

This paper outlines a summary of the methodology for conducting an evaluation of the conditions and choosing the appropriate PPE by assessing the hazards associated with the work environment. The process consists of a Job Hazard Analysis (JHA) combined with a Risk Assessment (RA) in order to develop a complete Job Safety Analysis (JSA). Oftentimes, the JHA is done without the RA leading to the inappropriate selection of PPE as the JHA alone does not consider the potential hazards created by the use of PPE. Additionally, as the work, environment,

or responder conditions change, or if there is an indication that the control measures are not working as intended (e.g., several responders have heat-related injuries), the JSA process is repeated to ensure that control measures are still current and effective.

This methodology will create an effective PPE program by 1) ensuring that the selected PPE is the best suited for that particular job; 2) attempting to reduce responder discomfort; 3) potentially reducing waste and disposal of PPE; and 4) maximizing responder efficiency and effectiveness by avoiding unnecessary stress.

All of this information and support appendices have been published by the American Petroleum Institute (API) in a document titled: Recommended Practice 98, Personal Protective Equipment Selection for Oil Spill Responders (2013) available through API at: http://www.techstreet.com/api/products/1862449.

BACKGROUND:

In August 2013, the American Petroleum Institute (API) published a Recommended Practice (RP) titled: Personal Protective Equipment Selection for Oil Spill Responders, First Edition. This work was initiated as a post-Deepwater Horizon oil spill (2010) Joint Industry Project by the API Oil Spill Preparedness and Response Subcommittee (OSPRS) in cooperation with international organizations (e.g., International Oil and Gas Producers Association, International Petroleum Industry Environmental Conservation Association) and the government executive committee (U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), U.S. Bureau of Ocean Energy Management (BOEM) and Pipeline Hazardous Materials Safety Administration (PHMSA)). The work was led by the Project Leader, John Husum, with support from safety and health representatives from the Occupational Safety and Health Administration (OSHA), API Safety and Health Subcommittee, USCG, EPA, oil industry and oil spill removal organizations (OSROs).

This work product is one of many being produced by the Oil Spill Preparedness and Response Joint Industry Task Force (OSPR JITF) organization. Other initiatives include response planning, dispersants, shoreline protection, in-situ burning and mechanical recovery. All of the projects entail collaboration among industry, government and academia and have the goal of improving the oil spill response system using the lessons learned during the Deepwater Horizon (DWH) oil spill.

INTRODUCTION:

During the Deepwater Horizon oil spill response, the oil and gas industry convened a Joint Industry Oil Spill Preparedness and Response Task Force to address the current oil spill response program. The purpose was to evaluate the processes in place (the Nation’s ability to respond to a Spill of National Significance such as DWH) and lessons learned during the DWH oil spill response. The goal was to find areas for improvement and then take action to make that change. The findings of the JITF from the initial meeting as they related to the cleanup efforts and personal protective equipment (PPE) included 1. Safety plans and PPE requirements were not adjusted to reflect responders’ environment; 2. Inappropriate and potentially harmful decisions were made; 3. Heat stress became the most significant cause for worker illness; and 4. The lack of experienced safety officers may have contributed to poorly developed safety plans. An example of this can be summarized in one photograph taken of workers removing tar balls from the beach (photo 1).

Photo 1: Workers on beach (USCG, 2010)

This paper discusses the recently published Recommended Practice 98 by the American Petroleum Institute titled: Personal Protective Equipment Selection for Oil Spill Responders. The purpose of the document is not to be a "how-to" guide; rather, it is a guidance document that discusses how proper PPE selection may be a useful control measure for responders when engineering and administrative controls may not be feasible or effective in reducing exposure to acceptable levels. Unlike other PPE reference materials that solely discuss the types and properties of PPE, the focus in this document is on the PPE selection process using a risk based decision making as well as its technical evaluation based on the hazards present.

FINDINGS:

Choosing and implementing PPE as a response control measure is never a "one-size-fits-all" solution. A general PPE selection matrix is a useful tool, but the proper selection of PPE requires a risk assessment. Further, when working conditions change or the training provided to responders is no longer appropriate due to changing conditions, a reassessment is necessary. Response organizations, due to the failure to assess hazards appropriately, may overprescribe PPE in an attempt to ensure both compliance and protection; however, this approach has its drawbacks because the unnecessary use of PPE may actually increase the risk of injury or illness and diminish workers' commitment to the safety program in place.

During the Deepwater Horizon oil spill response, PPE was often overprescribed. Although the intent was to protect the workers to a level perceived as "acceptable" to OSHA, the strategy backfired. The use of the DWH PPE Matrix was considered the gold standard and deviations from it were not typically deemed appropriate as it would be perceived as relaxing the standard. In a sense, its inclusion the site safety plan "codified" it for untrained safety personnel (OSHA, 2010). This mindset resulted in unintended, severe consequences – heat stress being the principal one. According to the National Institute for Occupational Safety and Health (NIOSH) the number one health and safety risk was from heat injuries. As stated in their Health Hazard Evaluation (HHE), "In most work sites evaluated, the conditions for heat stress were present, significant, and often the most pressing concern for the health and safety of response workers" (NIOSH, 2011, p. 12). A risk assessment may have been performed during the initial PPE needs assessment but was not redone to ensure that the controls did not increase the risk from another hazard (such as heat stress, in this case). NIOSH (2011) continues in their HHE, "Even at beach cleaning worksites where oil residue was judged by our teams to be heavy, worker exposure to oil residue was typically observed to be limited, with no evidence of exposure to dispersant" (p. 13).

NIOSH goes on to note that:

> The role of PPE worn by workers is intended to be a protective one to prevent harmful exposures. It is imperative to conduct continual evaluations of the need for specific PPE such as full-body coveralls throughout emergency responses such as this to determine their necessity. When exposures have been evaluated and determined to be minimal or insignificant, overuse of PPE can have an unintended effect of burdening the worker with unnecessary gear that can exacerbate heat stress, limit visibility, and increase the possibility of slips and trips. It is important that trained occupational safety and health professionals develop and implement guidelines for determining when PPE use is truly necessary. Balancing the need to protect workers from potential exposures without creating unnecessary hazards for workers from too high a level of PPE is critical. (2011, p. 12)

NIOSH was not alone in their findings. OSHA states in their report that PPE was "essential for protecting workers..." but that they (OSHA) "stressed throughout the response that decisions about PPE should be based on a scientific characterization of the hazards, including air sampling" (OSHA, 2011, p. 9). On the DHW PPE Matrix, it is footnoted that certain PPE (e.g., full body CPC [chemical protective clothing]) should only be worn when a "specific hazard associated with the given job exists and warrants wearing of this protection," and that this is decided by the on-site safety representative conducting a field Job Hazard Analysis (OSHA, 2010). This seemingly mundane footnote is in fact at the crux of the matter, the situation the Recommended Practice (RP) is meant to alleviate.

RESULTS:

Job Safety Analysis Process

Though practitioners may use other terminology and similar processes, the RP provides a methodology for conducting an evaluation of the conditions and choosing the appropriate PPE by assessing the hazards associated with the work environment. The process, embedded in the National Incident Management/Incident Command System, consists of combining:

Job Hazard Analysis (JHA) + Risk Assessment (RA) = Job Safety Analysis (JSA)

Often a JHA is done without the RA. As the work, environment, or responder conditions change, or if there is an indication that the control measures are not working as intended (e.g., several responders have heat-related injuries), the JSA process needs to be repeated to ensure that control measures are still current and effective.

In order to start the process, the mission goals, objectives and operational tactics must be known. The Safety Officer should be working closely with the Operations and Planning Sections to determine what the specific tasks and work assignments will be for the next operational period. During the development of tactics, the Safety Officer determines what the hazards are associated with those tactics, develops control measures to reduce or mitigate the risks, and ensures that the residual risk has not been increased with the implementation of the control measure(s).

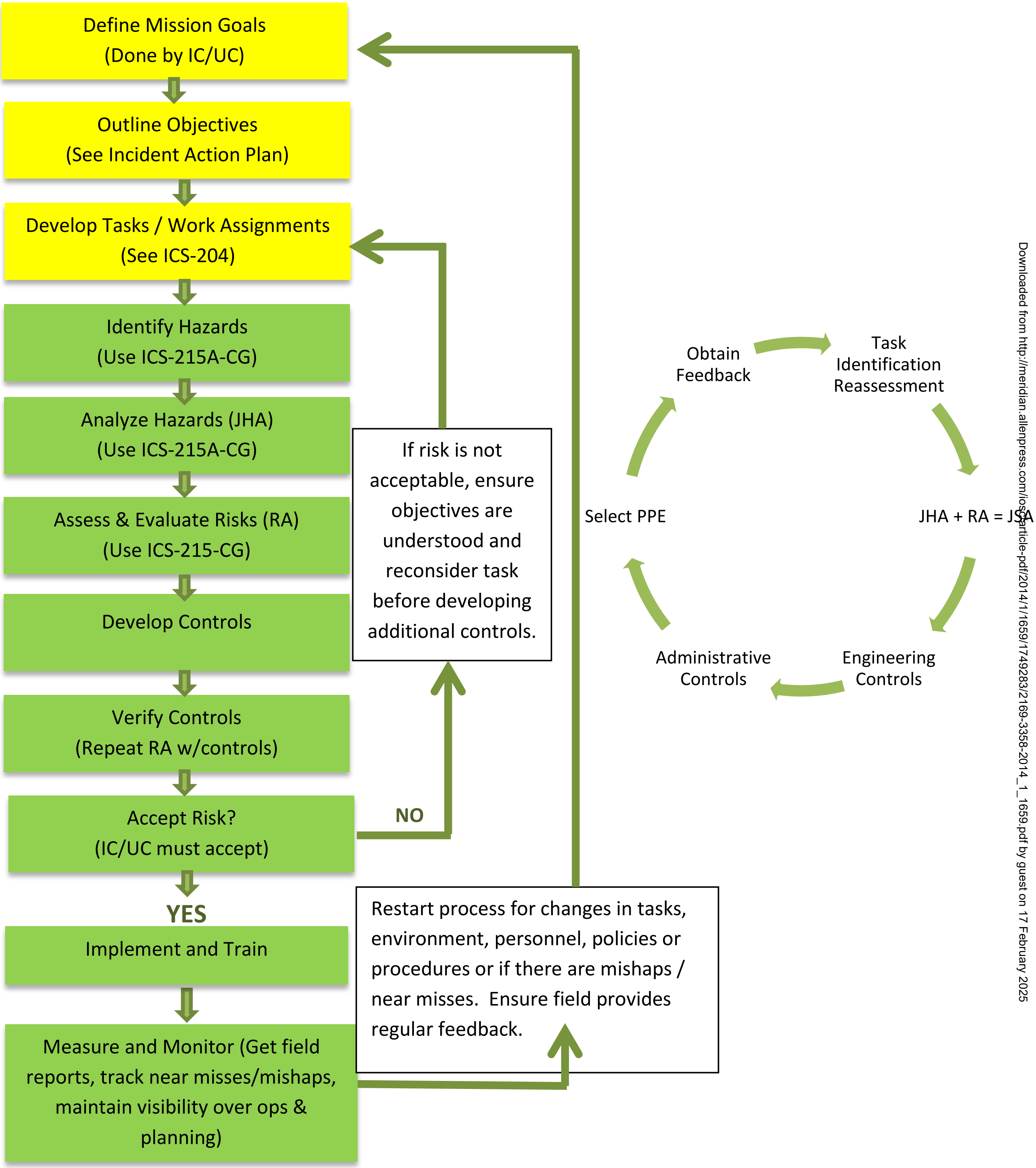

Figure 1: Risk Assessment Flow Chart (API, 2013, p. 11)

Working with the Operations Section is critical to ensure that controls are not only feasible for implementation in the field, but that they will not interfere with the operations, potentially creating more risk (e.g., loss of visibility with respirator use or tactile grip with thick chemical gloves, or physical hazards such as slips, trips and falls). Working with the Operations Section also allows the Safety Officer to gain a better understanding of the work assignments and the specific tasks that will be done to accomplish the objectives. Frequent, open communication allows for discussions of the options available to the Operations Section to accomplish the objectives and the risk associated with each of the options. The development of a PPE plan with the coordination and cooperation of Operations personnel will lead to greater understanding of the need for the PPE and subsequent compliance.

As depicted in Figure 1, the risk needs to be assessed several times during the process. There are many ways to assess the risk ranging from qualitative (e.g., low, moderate, high) to qualitative (using a risk matrix, for example). The RP outlines one such method which that can be used complementary to the ICS form 215A-CG which contains a risk assessment process (http://www.uscg.mil/safety/cg1132/NIMSsafetyofficer2.asp).

Implementation of Control Measures

Once the controls have been chosen and the risk accepted, responders and safety personnel need to be trained on the PPE (e.g., its purpose, use, decontamination/disinfection, storage, and disposal) and the JSA used to develop the PPE program. Training during a response is often time constrained, so the reasons as to "why" the PPE was chosen (i.e., the JSA) may not be discussed. This oversight may derail an otherwise successful PPE program as the responders need to be able to give informed feedback to their supervisor and safety personnel. This information is critical to understanding if the controls chosen are appropriate and functioning as intended. Likewise, as conditions change (e.g., working conditions, oil consistency, recovery methods, environmental, work force) or if there is a mishap or near miss the need for feedback becomes even more essential. The PPE safety plan needs to follow a continuous improvement cycle – similar to Deming's Plan-Do-Check-Act model. The plan evolves as the work does.
In summary, an effective PPE program:

- Ensures that the selected PPE is the best suited for that particular job
- Attempts to reduce personal discomfort
- Recognizes a possible decrease in manual dexterity
- Strives for a reduction of waste and disposal
- Maximizes responder efficiency and effectiveness by avoiding unnecessary stress
- Encourages and solicits for responder feedback as to the effectiveness of the controls in place

Initial Site Evaluation

Before responders can begin work, though, a site evaluation needs to be conducted to gather preliminary evaluation data and perform a site characterization. During this initial comprehensive survey the chemical and physical hazards are identified and work zones are delineated. The decision as to what PPE evaluators need to don during this process can be difficult to establish as the hazards are still yet unknown. The RP offers solutions such as learning as much as possible about the potential hazards before entry (e.g., Safety Data Sheets, videos from news media feeds, observations from other first responders such as the fire department), and developing an initial site safety plan. Likewise, discussed are the key pieces of equipment that each entrant should have, such as air monitors, in order to assess the hazards.

CONSIDERATIONS:

Before stating the different types and uses of PPE typically employed by oil spill responders, the RP discusses how the working environment and fatigue can affect the responders and how they must be accounted for in the risk assessment process. Cleaning up oil spills during severe weather (e.g., excessive heat or cold, rain, ice, wind, etc.) can complicate the hazard matrix. The conditions affect responders differently, but there may be a decrease in capabilities and work productivity while there may be an increase in exhaustion levels and mishaps or near misses. The risk assessment cannot be completed unless the Safety Officer considers the working conditions and their potential effects on the responders. Guidelines on how to assess the risk posed by temperature extremes are included in the RP.

Likewise, the stress and exhaustion levels of the responders will affect their abilities to work safely. Adding PPE to workers already stressed can create negative results unless that stress is accounted for in the risk assessment process. Stress in this case may be from the hours worked and the conditions, but can also be a result of the PPE used. Safety Officers need to consider the restrictions posed by PPE in their overall assessment.

Types and Kinds of PPE

The remainder of the RP covers the PPE typically used on oil spill responses to protect responders from chemical, biological, and physical hazards. The sections are broken down by PPE's function, such as protecting the lungs, skin, feet, hands, hearing etc., and hazardous conditions (e.g., working over water; vehicle safety, in-situ burning), and each section is similarly formatted for ease of use. There is information on the requirements for the protection (i.e., OSHA regulations, consensus standards), how the PPE works to reduce or prevent exposure, and how to assess and evaluate the hazards in order to choose the most appropriate PPE for the responder. This information is further compiled in an appendix where there is a matrix comparing the types of PPE to the hazards they address, considerations that need to be taken into account, the design criteria for the PPE (e.g., ANSI Standard), activities where that PPE may be used and where in the RP the information can be found.

CONCLUSIONS:

The Deepwater Horizon oil spill response was the largest unintentional marine oil spill in history of the petroleum industry. From it, many lessons were learned. The complexity of the event due to its size, distance off-shore, and sheer number of assets and responders had never before been experienced. The overuse of PPE was not the biggest lesson learned, but it is one of the easiest to correct. From here, safety professionals and supervisors alike need to be trained to assess the risk during all phases of the planning and response cycle. PPE is never a "one-size-fits-all" solution to the potential hazards and may actually increase the risks responders face. Likewise, PPE plans such a PPE Matrix must be a living document, being reviewed and updated continuously to keep up with the changes in the tasks, environmental conditions, and responder stressors. Implementation of the ideas in the new Recommended Practice 98 will ensure that PPE is not used blindly, that there are processes in place to ensure the most appropriate PPE is selected, that responders are properly trained with a better understanding of the "why," and that there is a continuous reassessment of the PPE needs based off of feedback and field observations.

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