



## Senior Service College Fellowship Program

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“Pursuing the Delta ~  
Maximizing Opportunities to Integrate Sustainability in the Funding Process”



Identifying When Sustainability Benefits Outweigh Costs in Funding Decisions

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The top two images on the cover are from operations in Iraq. The bottom image is the Pentagon.

Top Left

U.S. Forces burning refuse in open burn pit at Balad Air Base, Iraq in March 2008  
(Printed in Arizona Daily Star)

Top Right

Tactical Garbage to Energy Refinery (TGER) incinerator being tested in Iraq in April 2008 (Printed in Biomass Energy Journal)

Bottom Center

Picture of Pentagon (Printed in Behance.net)

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**PURSUING THE DELTA**  
**Maximizing Opportunities to Integrate Sustainability in the Funding Process**

by

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## **ABSTRACT**

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One of the newest challenges facing senior Army staff is how to insert sustainability considerations into the budget process as the demand for these measures intensifies and the funding stream diminishes. Sustainability includes reducing dependence on natural resources as well as preserving the balance of complex ecosystems everywhere the Army operates. Global competition for natural resources makes this an emerging necessity for our deployed forces. Additionally, the Army also faces an overwhelming public demand for stewardship within our own country that cannot be ignored. In an era of growing transparency and scrutiny, Army leadership needs to be assured that appropriate due diligence was conducted within the funding processes in regards to the impact of investment recommendations on all aspects of natural resource conservation and protection. The purpose of the paper is to identify opportunities to maximize sustainability options within the existing PPBES and Acquisition frameworks in order to provide Army leadership with an improved analysis to support enduring financial decisions.

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## ACRONYMS

ACAT	Acquisition Category
AEPI	Army Environmental Policy Institute
AMSAA	Army Materiel Systems Analysis Activity
APGM	Army Programming Guidance Memorandum
APPG	Army Planning Priorities Guidance
ASA FM&C	Assistant Secretary of the Army for Financial Management and Comptroller
ASA IE&E	Assistant Secretary of the Army for Installations, Energy and Environment
ASCP	Army Sustainability Campaign Plan
ASPG	Army Strategic Planning Guidance
BRP	Budget Requirements and Program Board
CAA	Center for Army Analysis
CASCOM	Combined Arms Support Command
CASI	Center for Advancement of Sustainability Innovations
cASM	Contingency Acquisition Support Module
CBA	Cost Benefit Analysis
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
COWC	Commission on Wartime Contracting in Iraq and Afghanistan
CPR	Capability Portfolio Reviews
DA	Department of the Army
DASA CE	Deputy Assistant Secretary of the Army for Cost and Economics
DFAR	Defense Federal Acquisition Regulation
DODI	Department Defense Instruction
DOE	Department of Energy

ECP	Engineering Change Proposals
EMD	Engineering Manufacturing and Development
EO	Executive Order
EPA	Environmental Protection Agency
EQT	Environmental Quality Technology
ERDC	Engineering Research and Development Center
ESOH	Environment Safety and Occupational Health
FAA	Functional Area Analysis
FAR	Federal Acquisition Regulation
FBCF	Fully Burdened Cost of Fuel
FBCW	Fully Burdened Cost of Water
FRP	Full Rate Production
GCV	Ground Combat Vehicle
HN	Host Nation
ICD	Initial Capabilities Document
JCIDS	Joint Capability Integration Development System
JROC	Joint Readiness Oversight Council
KPP	Key Performance Parameters
LOGCAP	Logistic Civil Augmentation Program
MAESMO	Methodology and Analysis of Energy Security in Military Operations
MDEP	Management Decision Packages
OCO	Overseas Contingency Operations
OSD	Office of the Secretary of Defense
PA&E	Program Analysis and Evaluation
PEGs	Program Evaluation Groups

PESHE	Programmatic Environment Safety and Occupational Health Evaluation
POM	Program Objective Memorandum
PPBES	Planning, Programming, Budget and Execution System
QDR	Quadrennial Defense Review
R&D	Research and Development
REF	Rapid Equipping Force
RFP	Request for Proposal
ROI	Return on Investment
SERDP	Strategic Environmental Research and Development Program
SMP	Sustain the Mission Project
TAP	The Army Plan
TGM	Technical Guidance Memorandum
TRAC	TRADOC Analysis Center
TRADOC	Training and Doctrine Command
TWV	Tactical Wheeled Vehicle
UCF	Uniform Contract Format
USA	Under Secretary of the Army
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology & Logistics
VCSA	Vice Chief of Staff of the Army
VECP	Value Engineering Change Proposals

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Imagine...

*It is 2016, Iran has just invaded the Majnoon oil fields in southern Iraq setting them ablaze; a tsunami has hit the southeast coast of Africa leaving thousands of refugees in a precarious migration to Somalia where their camps are being brutally terrorized. There is a domestic crisis in Texas where 3 years of severe drought has devastated the Tularosa aquifer causing an overwhelming surge of illegal aliens at the Columbus, NM entry point, desperate to escape the burning arid conditions but causing riots and bloodshed as they penetrate the border less than 10 miles from Fort Bliss. The situation threatens the rest of the southern border states as a severe shortage of both fuel and water make response along the border an enormous challenge. You are the Chief of Staff of the Army in a meeting with the National Guard leadership as you prepare to brief Chairman of the Joint Chiefs of Staff on options for a multilateral response. Ann Curry is now the Pentagon spokesperson and is clamoring at your door to validate claims that the Army can respond to each crisis with the equipment in its inventory. The new Tactical Wheeled Vehicle has just been fielded to both Active and Reserve units. Access to and resupply of liquid fuel will be a critical obstacle at each crisis site....Can you roll?*

The essence of that question is actually – are you sustainable to operate in this environment? The answer depends on actions taken now between leadership's direction and actions by the staff. The decrease in defense funding will require greater due diligence by staffs at all levels at each point of the decision making processes. In fact, these processes have already begun to incorporate sustainability considerations. However, the pace and permeability of this criteria is not yet where it could be. Pursuing this delta is what we can and should be doing. When the inevitable challenge arrives – leadership needs to be able to face the American people and the soldier with confidence that force sustainability was a priority in every key investment. This paper will target aspects of two key existing processes, PPBES and Acquisition, to discuss opportunities to pursue the delta to integrate sustainability in those fiscal decision frameworks. First, a look at the priority of sustainability within our current leadership guidance as well as the challenges of budget constraint and investment transparency is needed in order to provide context to the issues.

## PART I. ESTABLISHING THE CONTEXT

### Recognizing Sustainability as an Operational Necessity

The Chief of Staff of the Army, General Casey, describes the evolving character of persistent conflict to have trends that include failing states, resource demand, climate change and globalization.<sup>1</sup> Further, he states that “Future conflicts will be unpredictable and may arise suddenly, expand rapidly into unanticipated locations, and last for unexpected durations.”<sup>2</sup> The common denominator in these threats is the need for quick response forces that are sustainable at a level beyond our current capability that is vulnerable due to dependence on liquid fossil fuel among other things. Sustainability has evolved in the Army vernacular. It was formally introduced in the 2004 Army Strategy for the Environment that used sustainability as its foundation paradigm with a systems approach for the Triple Bottom line: Mission, Environment and Community.<sup>3</sup> Over the past 7 years, leadership has come to the realization that the triple bottom line is a concept that extends well beyond environmental stewardship. In fact, it is as applicable to every contingency scenario in the Army’s deployment plans. Sustainability is a capabilities enabler by enhancing the lethality, agility, versatility, and interoperability. In addition, it is now synonymous with survivability for both deployed soldiers and host nation populations due to the critical nature of natural resources and operational energy needs.

Reducing reliance on fossil fuels has been a national goal for several years for both environmental and security reasons. However, the campaigns in Iraq and Afghanistan have demonstrated that this reliance has an even greater immediate and high consequence event for deployed military forces. Hundreds of casualties each year

are being inflicted on our forces in Iraq and Afghanistan during resupply convoy missions.<sup>4</sup> The Feb 2010 QDR recognizes the importance of sustainability with both climate change impacts that exacerbate global instability and threaten domestic infrastructure as well as the imperative need for operational energy security. The Feb 2010 report states,

“Energy efficiency can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines, which are vulnerable to both asymmetric and conventional attacks and disruptions.”<sup>5</sup>

In May 2010 the Vice Chief of Staff of the Army (VCSA) and the Under Secretary of the Army (USA) approved the Army Sustainability Campaign Plan (ASCP) and directed that it be an “...organizing principle integrated across the Department’s missions and functions to: Institutionalize sustainability in doctrine, policy, training, operations, and acquisitions.”<sup>6</sup> The ASCP defines sustainability through the following 4 tenets:

- 1) Developing, producing, fielding, and sustaining materiel that is more energy efficient, is capable of using renewable energy resources, minimizes the use of hazardous materials, and generates less waste.
- 2) Ensuring the Army has sufficient access to training and testing resources and incorporating sustainability into operational planning and execution, so the Army can continue to effectively train today and in perpetuity.
- 3) Expanding our commitment to sustainability by instilling sustainable practices into all levels of our Soldier and Civilian education programs
- 4) Providing services and operating facilities in a manner that reduces consumption of energy, water, and other resources, promotes the use of renewable energy sources, enhances quality of life, and continues to protect the environment.<sup>7</sup>

In addition, a key point on the integration of sustainability in the operational environment lies in the implementation of the recently published Army Counterinsurgency Manual, FM 3-24. In austere locations every power source is a

concern, not just petroleum. Basic services rely on some source of power and the more sustainable the fuel source, the more reliable the service. Equipment used by US forces is frequently used to establish initial life support services for host nation populations whose infrastructure has been devastated. These services are vulnerable unless self reliant. The more resilient these services are, the more effective our operations are. FM 3-24 section 8-39 states:

“When US forces restore and transition essential services to the HN government, they remove one of the principal causes insurgents exploit. This action greatly assists the HN government in its struggle for legitimacy. Competent leaders can expect insurgents to conduct attacks against restored services.”<sup>8</sup>

Our units in theatre can bear witness to the need for sustainability better than any manual, policy or white paper can ever articulate. The need is real, it is immediate and it must be part of our funding decisions in order to deliver it.

### Challenges of Fiscal Efficiencies and Process Transparency

The challenge many see is how to incorporate a requirement for sustainability when the defense budget is facing drastic unprecedented cuts. Obviously there is no new funding to support a whole scale overhaul of equipment and facilities to make them suddenly sustainable. Indeed, there is not enough funding to even completely maintain the current Army inventory...and that is before Secretary of Defense Gates' efficiencies are implemented. In August 2010, Secretary Gates called for a comprehensive review of how all services operate with a goal of identifying \$100B in efficiencies over the next 5 years from all the services.<sup>9</sup> He provided a statement on 6 Jan 2011 that \$29B of the \$100B would come from the Army.<sup>10</sup> In addition to these cuts, the supplemental appropriation “Overseas Contingency Operations” (OCO) is projected to end by FY17.<sup>11</sup>

This creates an extremely tight budget for the Army and validated requirements that are not able to shift into the base budget will become completely unfunded.

This also means that scrutiny of funding decisions will be plentiful. Already the Department of the Army undergoes several external audits on an annual basis and nearly every program is subject to this examination. Important to realize is that the massive public interest in sustainability progress will likely drive Congressional inquiries focused on the degree to which sustainable options were considered in Army investment decisions. Auditors will want to see that the Senior Leader decisions were based on criteria that adequately reflected soldier resilience on the battlefield and environmental stewardship everywhere the Army operates.

In addition, in May 2009, President Obama signed Executive Order (EO)13514, Federal Leadership in Environmental, Energy, and Economic Performance. This order outlines goals and responsibilities for each agency to include requiring a designated Agency Senior Sustainability Officer. Secretary of Defense designated Under Secretary of Defense for Acquisition, Technology and Logistics, USD(AT&L) for the DoD. Secretary of the Army designated the Under Secretary of the Army (USA) for the Army. Each of these positions is tasked with several actions through the Executive Order to implement sustainability within their agencies. Important to note that they are also responsible for transparency of their efforts in achieving these actions. The EO states specifically: "Finally, it is also the policy of the United States that agencies' efforts and outcomes in implementing this order shall be transparent and that agencies shall therefore disclose results associated with the actions taken pursuant to this order on publicly available Federal Websites." <sup>12</sup>

The operational need coupled with a declining budget and demand for transparency will force staffs at all levels to make a conscious effort to ensure they have performed adequate due diligence of including sustainability considerations within their existing decision processes.

## **PART II. PLANNING, PROGRAMMING, BUDGET AND EXECUTION SYSTEM (PPBES)**

The development and vetting of the Program Objective Memorandum (POM) through the PPBES process is an institutional battle drill within the Army. The POM is the central document that assigns resources against specific requirements once all of the staff analysis is complete through the PPBES process. The PPBES process is complex, overlapping and integral to every program in the Pentagon. Appendix A provides a compressed diagram of the complete process to demonstrate its multi-layered intricacy.<sup>13</sup> It starts with senior leader guidance and works its way through a labyrinth of staff analysis, briefings and finally fiscal recommendations. This paper will not attempt to address the entire process, rather it will focus on three elements within the process that are integral to the transformation of guidance into staff recommendations: the Technical Guidance Memorandum (TGM), the Program Evaluation Groups (PEGs) and the Cost Benefit Analysis (CBA).

### Guidance from The Army Plan (TAP) to the Technical Guidance Memorandum (TGM)

The Army Plan (TAP) has 3 portions that directly impact the funding process: The Army Strategic Planning Guidance (ASPG); the Army Planning Priorities Guidance (APPG); and the Army Programming Guidance Memorandum (APGM). Collectively these parts provide Senior Leader guidance on planning and programming elements for the budget cycle. An initiative must be consistently captured in the TAP to demonstrate a top leadership priority for funding and indeed discussion of sustainability initiatives has emerged in the 2011 version. Leadership has provided a clear foundation for the staff to actively pursue sustainability through their guidance in the ASPG and the APPG. Starting with the draft 2011 ASPG one can see that “Invest in Energy Security and

Sustainability Programs” is one of 17 “Near Term Objectives for 2011-2012.”<sup>14</sup> Further, the draft ASPG contains a strong message on the importance of investing in sustainability through the following implementation measures under this objective:

- 1) Focused investments on energy efficiency, renewable energy and assured access to reliable energy on installations, operations and weapon systems;
- 2) Reduction of energy consumption through improved management decisions; and
- 3) Reduction of dependence on fossil fuels and improving water management practices.<sup>15</sup>

The next part of the TAP, the APPG, provides a priority for the key initiatives based on the four Army Imperatives: Sustain (Soldiers, Families and Civilians); Prepare; Reset; and Transform. Sustainability is addressed under the Transform imperative. The draft APPG contains the following verbiage:

“Consistent with Army Senior Leader Guidance, the Army must continue to transform its usage of power and energy for weapons systems and operations. Contingency operations over the past few years have amplified the vulnerability of reliance upon liquid fuel to support operations. Energy Security at home and in the theatre is an operational imperative that is a capabilities enabler. It is vital that the Army develop and deploy systems that make more efficient usage of fuel and energy, allow the incorporation of alternative sources of energy, and enhance or expand the capabilities of our operations.”<sup>16</sup>

The APGM is part III of the TAP and further defines the senior leader guidance for the programming activities of the senior staffs. The APGM is drafted by the Deputy Chief of Staff G-8 Program Analysis and Execution (PA&E). All justifications for requirements must align themselves with the APGM to be competitive for validation and then actual funding. This is the key document in the POM cycle for resource managers to focus their efforts as they analyze their data and translate their funding requests in terms of the priorities it highlights. If a requirement cannot be related to the guidance in the APGM, it stands little chance of getting recognized in the validation process. Annex



A of the APGM is “Guidance to Program Evaluation Groups (PEGs) and Commands.”

Obviously this is a golden opportunity to insert language requiring sustainability considerations be a priority. The draft APGM 12-17 contains the following reference to sustainability in Annex A:

“Review and determine critical requirements for the Army Energy Security program ensuring the program provides the total cost of the proposal, the benefits that will result, and the proposed resource strategy.”<sup>17</sup>

This language is not as strong as the verbiage in the ASPG and the APPG. Since it is the focus for the PEGs, it would be much more effective in the programming and budget process to have this verbiage in Annex A of the APGM clearly articulate the active role the PEGs should take in their reviews for ensuring sustainable options were part of the analysis, particularly since it can impact multiple programs. The role of the PEGs is pivotal in the development of recommendations for Senior Leader budget decisions so it is paramount that the guidance they receive adequately reflects emphasis on sustainability.

Guidance to the PEGs is further defined in Appendix C of the APGM which is the “Technical Guidance Memorandum (TGM)”. The TGM “outlines program intent and provides specific guidance to the Program Evaluation Groups with respect to resource allocation.”<sup>18</sup> The current draft of the POM 12-16 TGM addresses a 50% increase in Energy Security Resource Allocation from FY12 to FY16 of \$60M.<sup>19</sup> This is a positive step of course. However, in the “General Guidance” portion of the TGM the only reference to “Energy Initiatives” describes the following two points:

- 1) Complete all metering required by the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 by 2012 within existing resources.

- 2) Any new utilities privatization requirement must have a favorable, DASA-CE certified, Cost-Benefit Analysis and gain approval of Three-Star BRP prior to incurring any commitments.<sup>20</sup>

Certainly these efforts are important, but unfortunately this verbiage was significantly diluted from the emphasis on the drive for renewable energy or sustainable alternatives that were voiced in both the ASPG and the APPG. Thus, a very important and critical opportunity exists right here with the drafting of the APGM and TGM to influence the work of the PEGs. Language consistent with the intent of the ASPG and APPG needs to be inserted in the “General Guidance” portion of the TGM to emphasize the responsibility of the PEGs and commands to include sustainability options wherever possible in requirements that could potentially utilize them.

Lastly, the APGM drafted for the 2012-2017 POM devotes an entire appendix to the Cost Benefit Analysis (CBA) requirement.<sup>21</sup> In this appendix it would be appropriate to insert language to add sustainability and energy reduction to the CBA evaluation criteria. This will be discussed further in the CBA section below.

### Program Evaluation Groups

One of the biggest exercises in the PPBES process is the review process at the DA level of all requirements first by Management Decision Package (MDEP) and then by Program Evaluation Group (PEG). As discussed above, guidance for the PEG chairs from the APGM and the TGM. There are 6 PEGs and they correspond to the major functional areas (manning, equipping, training, organizing, sustaining and installations). All programs within those areas are broken down into smaller program packages called MDEPs. Resource managers prepare detailed data analysis to justify their funding requirements that undergo intense scrutiny at the MDEP level and then culminates at

the PEG briefings. The PEG committees consist of co-chairs from the functional area and corresponding secretariat staff as well as a member from the G-3, PA-E, and ASA(FM & C), see diagram below.<sup>22</sup>

PEG Name	Co-Chair for Policy	Co-Chair for Requirements
Organizing	ASA(M&RA)	AASA
Manning	ASA(M&RA)	DCS, G-1
Training	ASA(M&RA)	DCS, G-3/5/7
Equipping	ASA(A&LT)	DCS, G-8
Sustaining	ASA(A&LT)	DCS, G-4
Installations	ASA(IE&E)	ACSIM

**Figure 1. Program Evaluation Group (PEG) Leadership**

These committee members have the responsibility of conducting tedious reviews of volumes of data, to include the new cost benefit analysis. The committee vets the material and determines which requirements to recommend to leadership for validation and funding. In order to provide leadership with a consistent evaluation of sustainability and energy security related considerations it would be most effective to add a staff member from the ASA(IE&E) office to the equipping, training, sustaining and installation PEGs. This member needs to be a subject matter expert in the sustainability area and would provide consistent evaluation of the objectives in the ASPG and APPG, (for the

Installation PEG it would be in addition to the senior staff Co-Chair who comes from ASA(IE&E)).

This is particularly important in light of a recent change to the POM process that changes it from a biennial review to an annual review.<sup>23</sup> The intent is to have the most current review possible of the next year's budget requirements because the needs in theatre have been changing so rapidly. All requirements will undergo a thorough analysis on an annual basis with the realization that funding is decreasing. This change will likely result in the PEGs putting a lower priority on requirements that do not provide a return on investment (ROI) within the new annual budget review cycle. This could put sustainability initiatives, whose full ROI typically spans several years, at a significant disadvantage unless there is committee membership that has expertise in this area. In addition, many sustainability requirements are too new to be incorporated in the requirements generating models such as the installation base requirements generating model. These will need to be reflected as line items in the MDEP and PEG briefs. In order for such line items to compete for validation and funding their impacts need to not only be articulated well by the program manager, but also understood by the PEG committee.

Finally, this committee member would provide substantial support in the review of Cost Benefit Analyses to identify gaps in analysis where sustainable options could/should be inserted to provide full due diligence of the courses of action.

## Cost Benefit Analysis (CBA)

In December 2009, the VCSA and the USA co-signed a memorandum to the Army staff mandating a standardized Cost Benefit Analysis (CBA) be conducted on every new initiative or adjustment to an existing requirement that exceeds a threshold of \$25M. <sup>24</sup>

The CBA is now an integral step in the programming process as requirements are vetted through each stage of justification. The Deputy Assistant Secretary of the Army for Cost and Economics (DASA CE) has developed a Cost Benefit Analysis Guide and provides blocks of instruction to teach resource and program managers how to build CBAs using a standardized format. The standardized format is a necessity to compare competing requirements against the same standard. In addition, with the fierce competition for funding, reviewers at all levels have begun to require a CBA. This makes it the ideal opportunity to insert sustainability considerations in funding analysis.

The basic goal of the CBA is balance as shown in the diagram below:

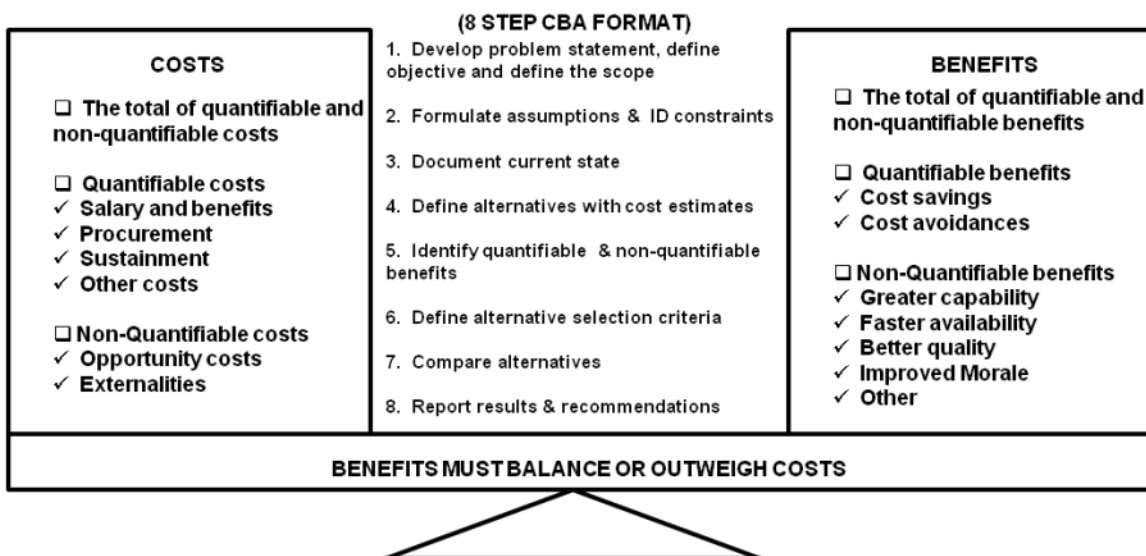


Figure 2. Cost Benefit Analysis<sup>25</sup>

This diagram is directly from the DASA CE Cost Benefit Analysis Guide and demonstrates that total benefits must equal or outweigh total costs. In the center of the diagram are the 8 steps of the standardized format, listed in more detail below. A summary explanation of each is provided at Appendix B.<sup>26</sup>

- 1) Develop the problem statement; define the objective and the scope
- 2) Formulate assumptions and identify constraints
- 3) Document the current state (the status quo)
- 4) Define alternatives with cost estimates
- 5) Identify quantifiable benefits and non-quantifiable benefits
- 6) Define alternative selection criteria
- 7) Compare alternatives
  - a) Compare costs and benefits
  - b) Define trade-offs and billpayers
  - c) Identify second and third order effects (cause and effect)
  - d) Perform sensitivity analysis and risk assessment
- 8) Report results and recommendations

A simple example would be a request that had pure quantifiable costs and quantifiable benefits so that the equation was straightforward and purely numerical. As one might expect, such a simple analysis is rarely the norm. Much more common are the requirements with complex considerations that are both quantifiable and non-quantifiable. Sustainability requirements can be captured in the quantifiable benefit category when they result in cost reduction, cost avoidance and productivity improvements. However, they also tend to encompass non-quantifiable benefits because of their far reaching impacts to soldier survivability and ecosystem health that are not easily assigned a dollar figure.

#### *Non-quantifiable benefits and 2<sup>nd</sup> and 3<sup>rd</sup> order effects*

It is essential that resource managers and reviewers in the MDEP and PEG briefings have a solid understanding of the role of non-quantifiable benefits in the CBA so that

they are adequately addressed. Minimizing or leaving out non-quantifiable benefits will result in unsatisfactory analysis on which to base leadership investment decisions. The DASA CE CBA guide lists examples of non-quantifiable benefits such as improved morale; compatibility; improved quality and security; and improved readiness.<sup>27</sup> Non-quantifiable benefits of sustainable solutions certainly include soldier security and improved readiness, but they can also include numerous other benefits regarding health and resilience not only of the soldiers but of the ecosystem and surrounding community who share the same natural resources.

These impacts can also be considered second and third order effects. The CBA guide states “In addition to the primary intended consequence of a decision, there can be second and third order effects. The concept of second and third order effects is based on a sequential cause and effect relationship.”<sup>28</sup> Non-quantifiable benefits are closely linked to second and third order effects because of the impact an initiative may have on stakeholders, frequently the public. This can be true for domestic initiatives on bases with the surrounding community and for non-traditional base camps in host nation settings. Factors such as reduction or elimination of toxic waste in water or the preservation of air quality by methods that don’t involve burning waste clearly have a positive impact on health risk for soldiers as well as local populations. This impact to stakeholders is a second order effect that results in the non-quantifiable benefit of reinforcing supportive relationships with the population, which becomes a third order effect. These types of second and third order effects can potentially expand exponentially for larger initiatives and so will the corresponding non-quantifiable benefits.

Of note here is the emerging concept of Ecosystem services. The Army manages over 13 million acres of land in the United States. Ecosystem services can be described as “the benefits of nature to households, communities, and economics”<sup>29</sup>. They include recreation, agricultural irrigation, wetlands banking, water purification and may soon include greenhouse gas credits for forested areas. Much work is being done in the public and private sector to identify numerical values for various ecosystem services. However, until those values are further developed, these services should be considered under the non-quantifiable benefit category as appropriate for CBAs which involve changes to Army real estate.

#### *Fully Burdened Cost*

As mentioned at the onset of this paper, sustainability can often equate to survivability. Significant work has been done to quantify the key factors involved in delivering fuel and water to end users on the battlefield, including force protection. This is referred to as the “Fully Burdened Cost” typically of fuel (FBCF) or water (FBCW). The concept of FBCF received strong attention from the Defense Science Board Task Force when they were tasked to study the Department’s dependence on fuel and its impact in an operational environment. The Task Force conducted their first study in 2001 and strongly recommended that the FBCF be included in both the acquisition and PPBES processes.<sup>30</sup> A memo signed by the Under Secretary of Defense for Acquisition, Technology and Logistics on 10 April 2007 directed that the Fully Burdened Cost of Energy be immediately included in the “trade off analysis conducted for all tactical systems with end items that create a demand for energy and to improve the energy efficiency of those systems, consistent with mission requirements and cost



effectiveness.”<sup>31</sup> The memo further directed that the policy would begin via a pilot program to “develop the most effective business practices to incorporate the fully burdened cost of energy into acquisition decisions.”<sup>32</sup> The Defense Science Board Task Force produced a follow-up report in Feb 2008 that reinforced its earlier recommendations that the FBCF still needed to be fully implemented in both the acquisition and the PPBES processes.<sup>33</sup>

To date, many tools for the FBCF algorithm have been developed to include a “Sustain the Mission Project (SMP)” sponsored by the Army Environmental Policy Institute (AEPI) and developed in conjunction with DA G4. A sample case study for the SMP for the FBCF is a Tactical Hybrid Electric Power Station (THEPS) based on supporting a Sustainment Brigade in Iraq. The THEPS example consists of power from a solar array, wind turbine, diesel generator and a battery. The study results indicate a potential fuel savings of over 138K gallons per year by utilizing the THEPS.<sup>34</sup> This would directly result in a reduction of convoy missions. Deputy Assistant Secretary of the Army for Cost and Economics (DASA CE) is working to establish annual guidance for FBCF cost figures for use in analysis of alternatives and is using the framework developed by the SMP project as a key source of its annual guidance. It is abundantly clear, that an analysis without the FBCF is incomplete for any initiatives that depend on liquid fuel. The DASA CE approved tools and annual FBCF figures need to be added to their CBA Guide under the Appendix D “Cost Estimating Models and Tools” so that they are recognized by and available to the entire resource management community.

The SMP project has also studied factors to fully capture the cost of water. Similar to the FBCF analysis, the SMP model for Fully Burdened Cost of Water (FBCW)

includes factors for the cost of force protection.<sup>35</sup> The FBCW SMP tool and methodology enables the user to compare attributes of emerging technological solutions in contingency scenarios. This decision support tool would also be an effective addition to the DASA CE CBA guide.

Another effort to quantify sustainability costs has been underway in the subject of waste management in contingency operations, also sponsored by AEPI. Building upon the concepts in the SMP project, the waste management decision support tool provides a close look at the fully burdened cost of managing solid and hazardous waste as part of life support services. This is a considerable challenge for our deployed soldiers when the most common options consist of either burning solid waste or paying host nation contractors to pick it up and often dispose of it in close proximity to drinking water sources. A description of the waste management analysis is provided at Appendix C.<sup>36</sup> Once it is fully staffed, this too will be another useful tool to contribute to the DASA CE CBA Guide.

So integral is the concept of Fully Burdened Cost, particularly that of liquid fuel, that it should be included in all operational planning models as these ultimately feed requirements discussions. In November 2010, a study on the comprehensive deployment planning and analysis of alternatives process was conducted. This study is entitled the Methodology and Analysis for Energy Security in Military Operations (MAESMO) and one of its focuses was the FBCF within key operational models. The study was conducted by the Office of the Assistant Secretary of the Army for Installations, Energy and Environment in conjunction with DA G4 and in coordination with CASCOM, CAA, AMSAA, TRADOC-TRAC and of course, DASA CE. The results

of the study showed that these organizations already have the capability to integrate FBCF in their models but until it is fully standardized this integration will be on hold. An example of MAESMOs findings was that by simply adding allocation rules and planning factors for alternative/renewable energy to CASCOM's data sets this would in turn enable the studies conducted by CAA to incorporate sustainability factors in their models which include the Force Generation (FORGE) model.<sup>37</sup> The finding of the MAESMO study points out how relatively minor updates to the Army's basic models can result in a significantly more comprehensive look at the FBCF. These agencies already understand the importance of such updates and are ready to execute once the FBCF factors are formally certified.

### **PART III. THE ACQUISITION PROCESS**

The Army Acquisition system is governed by several documents but its central direction comes from the Federal Acquisition Regulation (FAR), the Defense Federal Acquisition Regulation (DFAR) and DODI 5000.02. It is a very complicated process which this paper will in no way attempt to address in its entirety. However, there are numerous aspects of this vast process that could better incorporate sustainability considerations. This paper will focus on a few key opportunities, starting with the basic ESOH documentation.

There exists within the Acquisition system framework already a well known and executed requirement for a Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE) that is required of all programs regardless of their Acquisition Category (ACAT). The purpose of the PESHE is to incorporate ESOH management early in the acquisition process not only to ensure legal responsibilities are fulfilled but also to enhance performance, sustainability, deployability and reduce total ownership cost.<sup>38</sup> It seems the obvious location to insert emphasis on goals from the ASCP, particularly tenet 1 : “Developing, producing, fielding, and sustaining materiel that is more energy efficient, is capable of using renewable energy resources, minimizes the use of hazardous materials and generates less waste. “ Indeed, this meshes well with the content of most PESHE documents already. The PESHE must be integrated into the systems engineering process and per DODI 5000.02 it is required at Milestone B, C and the Full Rate Production (FRP) Decision Review.<sup>39</sup> A diagram of those milestones is below.<sup>40</sup>

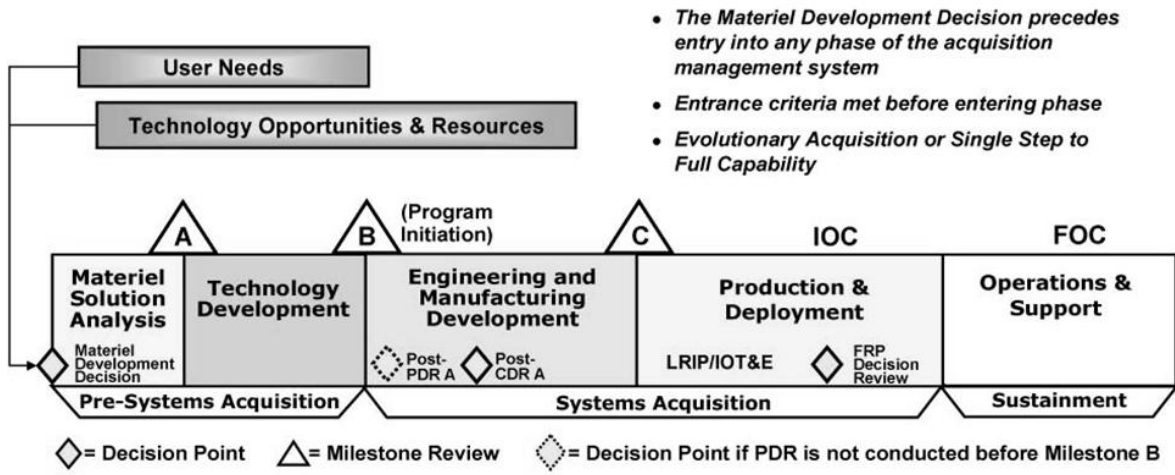


Figure 3. Acquisition Milestones

However, there are opportunities to increase the focus on sustainability in the acquisition process much earlier in the life cycle. Once again it starts with leadership emphasis from the highest levels.

Joint Capability Integration and Development System (JCIDS)

All of the opportunities thus far are a systematic progression of integrating sustainability into the institutional processes starting with senior leader guidance. However, a truly dynamic opportunity to move sustainability forward in large steps exists through the JCIDS process because of its direct link to major acquisitions. A diagram of the process is provided at Appendix D.<sup>41</sup> CJCSI 3170.01G describes the objective of the JCIDS process is “to ensure the capabilities required by the joint warfighter are identified with their associated operational performance criteria in order to successfully execute the missions assigned.”<sup>42</sup> Capability gaps are defined as requiring either a materiel or a non-materiel solution. Materiel solutions of course require an acquisition effort and must go through a series of steps to identify all the characteristics needed by

the solution to fulfill the operational capability gap. Key Performance Parameters (KPPs) are integral to the JCIDS process as they are the most significant characteristics of the material solution system. A formal recommendation by the Defense Science Board in their 2001 study, and re-emphasized in their 2008 report, was the need to establish and implement an Energy Efficiency KPP. Progress has been made in the form of a pilot effort as directed by the 2007 memo from USA(AT&L), but full implementation has yet to be instituted as results of the pilot continue to be reviewed.<sup>43</sup>

Instituting an Energy Efficiency KPP would have far reaching impacts. There is tremendous potential for increased combat effectiveness if energy efficiency and interoperability were reinforcing factors in the Functional Area Analysis (FAA) . The FAA is the first step of the JCIDS process and defines the tasks needed to achieve operational success when building the capabilities package.<sup>44</sup> If weapons, equipment and life support systems were designed so that energy source parts were multifunctional, interoperable and adaptable to renewable energy sources then the versatility of batteries, microgrids and powerpacks (to name a few) would be enormously increased. This capacity would be a new era for joint operations, joint logistics and interagency country development. These items could be produced with economy of scale and their simplicity would ensure long term relevance, reduction in training and overall vastly improved efficiency across the complete spectrum of deployment phases.

This requires consistent emphasis of the Energy Efficiency KPP at each stage of the JCIDS process until the capability package is through the Joint Readiness Oversight Council (JROC) and finally results in the Initial Capabilities Document (ICD) to start the

acquisition cycle. The ICD then becomes a foundation document in the acquisition process for the government and the contractor as the system progresses through the acquisition milestones. It also influences the language used in the procurement contracts.

## Sustainability Considerations in Contract Language

### *Request for Proposal*

Leveraging the research and technology assets from private industry is an absolute must in this era where the demand for sustainable products is being driven from several sectors besides defense. The Army needs to capitalize on this trend by insisting that contracting efforts incorporate language that makes sustainability part of the deliverable, whether it be a product or service. Dr. Ashton Carter, Under Secretary of Defense for Acquisition, Technology and Logistics, published a memo in September 2010 to the Service Secretaries mandating increased focus on executing efficient acquisition contracts. His memo states, “Real competition is the single most powerful tool available to the Department to drive productivity....Competition is not always available, but evidence suggests that the government is not availing itself of all possible competitive situations.”<sup>45</sup>

The first opportunity to energize contractor interest in sustainability goals is in the Request for Proposal (RFP) that provides information to prospective bidders on the scope of the contract and the criteria for selection among other things. Army RFPs follow a standardized format called the Uniform Contract Format (UCF). An outline of the UCF is provided at (Appendix E).<sup>46</sup>

Section M of this format pertains to the selection criteria or evaluation factors for the contract. Inserting language in the selection criteria that pertains to the ASCP sustainability goals will activate the competitive bid process to motivate contractors to address and commit their resources to pursuing those sustainability goals as part of their contractual responsibility should they be selected.

An example can be taken from the recent Ground Combat Vehicle (GCV) RFP dated 23 Dec 2010. Section M of this RFP describes 5 common evaluation factors: Technical; Schedule; Price; Past Performance; and Small Business Participation. Under the Technical factor is a subfactor of “Integrated Design” that will be assessed according to 5 risks. The fifth risk states:

“The proposed Mobility architecture has power consumption estimates that accurately account for the applicable subsystems in its Product Structure.”<sup>47</sup>

Another option to address this evaluation factor and emphasize the fuel efficiency goals would be to use language in the next RFP, before the Engineering Manufacturing and Development (EMD) phase such as:

“The Department will evaluate the offerer’s approach to maximizing fuel efficiency in the mobility architecture while optimizing performance for the applicable subsystems in its Product Structure.”

Further, a sustainability expert (energy or environmental) should be part of the transdisciplinary team that reviews the packets and makes recommendations to the Selection Committee or Board. If emphasis on sustainability goals were applied at the point of source selection and this criteria was specifically articulated in section M of the RFP, then the responsibility would be placed on the contractors in the initial stages of competition to ensure their product design addressed the goals.



## *Contract Clauses*

Sustainability requirements should be clearly incorporated in the actual contract once the selection process is completed. Pre-vetted contract clauses already exist for several ESOH considerations consistent with FAR Part 23. These are readily available in PESHE Handbooks and even the ASA(ALT) website which contains a library of ESOH information for use in contracting. An excerpt from the Army Environmental Center's PESHE handbook is provided at Appendix F to provide an example of existing language.<sup>48</sup> There is room to develop additional contract clauses consistent with the FAR that focus on sustainability goals. Templated language developed by subject matter experts with contract expertise is a tremendous tool especially when made available as part of the standard acquisition toolbox. Once the verbiage is inserted in the contract then the responsibility lies with the contractor to fulfill the sustainable criteria.

A related opportunity is the contract templates in expeditionary environments for base support requirements, particularly LOGCAP. LOGCAP contracting and subcontracting have come under heightened scrutiny for several reasons, one of which is their lack of energy efficient support. Their mission inherently provides support in areas where fuel and energy efficiency should be a prerequisite. This is a problem when it is precisely in the area where supplying energy puts personnel at risk. Army Materiel Command has been developing an automated web-based tool called "Contingency Acquisition Support Module" or cASM. The Commission on Wartime Contracting in Iraq and Afghanistan (COWC) specifically noted the potential of the "cASM" tool to facilitate improvements with life support contracts. They note that, "this

tool will assist with translating a combatant commander's requirement into a procurement package that includes all the required documents and approvals, a responsive contract statement of work, and any ancillary data or information for acquisition approval and contract action."<sup>49</sup> This is precisely where sustainability considerations need to be integrated to ensure that energy efficiency, sustainable waste management and other life support measures are appropriately addressed in the contracts. Naturally, the options for host nation support will be limited as far as being able to provide advanced technological support. But US companies that are involved in the LOGCAP subcontracts should be able to adhere to such sustainable considerations by using their capacity to reach back to the US industrial base for innovative solutions in order to win a contract. This is an excellent driver for private industry to aggressively pursue sustainable life support products. Further, if the life support products are simple, interoperable and interchangeable they then become transferable to host nation personnel – thus making them a very competitive product for the military to invest in.

In Oct 2009, USD(AT&L) Dr. Carter signed a memo designating cASM as a Special Interest program.<sup>50</sup> The cASM system is currently in the "limited User Evaluation and Initial Deployment phase". This is prime opportunity to integrate sustainability in the contingency contracting arena for life support services.

### Technology Insertion

Many large acquisition endeavors become an investment not only for the government but also for the contracting company in terms of expansion of their portfolio through successful product development. Companies want their products to be their calling cards and indeed, past performance is often a criteria in the selection process of

future contracts. As the global market for renewable energy systems and other sustainability efforts increases, industry will focus their R&D at an increasing rate to meet this demand and will want to showcase their success. All of those factors make insertion of technological advancements into defense procurement a powerful tool to achieve sustainability goals. The report on the 2010 QDR by Hadley and Perry, "QDR in Perspective," recommends inserting technological advances in the acquisition process in no more than 5 to 7 years due to the pace of technology maturation.<sup>51</sup> However, due to the overwhelming global demand for renewable energy, the advancements are likely to appear more rapidly. In order to utilize these advancements, the FAR provides a mechanism called the Value Engineering Change Proposal (VECP). Language can be inserted in the contract that can encourage VECPs. Then, during the development of the system if the contractor identifies and develops a proposal to update an existing design such as a more resilient material, simplification of a component design or switch to a multifunctional component then the contractor follows the VECP procedures to introduce the change for consideration. The incentive to the contractor is that they receive a percentage of the savings that the government would experience due to the insertion of the technology if the proposal is accepted.<sup>52</sup> The benefit to the government is a more relevant, efficient and sustainable piece of equipment.

This is in keeping with the November 2010 memo from Dr. Carter further emphasizing contractor incentives, "Implementation Directive for Better Buying Power - Obtaining Greater Efficiency and Productivity in Defense Spending". The intent of this memo is to provide guidance on achieving efficiencies in contracting using various

measures such as incentivizing contractor productivity and innovation in industry. The message is clear – contracting will be under intense scrutiny by several stakeholders to include the Army Audit Agency, Congress and the Government Accounting Office, Office of Management and Budget, as well as a plethora of private sector think tanks to ensure investments yield the highest productivity possible. The opportunity here is the enormous leverage that can be achieved with deliberate partnership with industry to insert proactive technology which is the essence of sustainability development.

Technology insertion can also be accomplished by governmental research and development discoveries. The mechanism in the acquisition process that covers this is through Engineering Change Proposals (ECP) and of course results in savings to the government, not shared with the contractor. In addition, there is research being done in the Army in the lane of “Environmental Quality Technology”(EQT). This effort is currently divided among numerous offices right now. The EQT program provides great opportunity for increased focus to include updating its strategy to more fully integrate energy initiatives.

Key to this internal department R&D effort is the fact that all services are aggressively pursuing solutions to sustainability of soldier and mission requirements in contingency environments. It would be most efficient and effective to have a strong coordinated effort across services to maximize the advancements in research and lessons learned in testing and fielding. As stated earlier, interoperability provides the most benefits to our forces to be sustainable at every phase of an operation. The Strategic Environmental Research and Development program (SERDP) is an OSD level organization that was specifically mentioned in the February 2010 QDR to be the lead

for climate change impact analysis.<sup>53</sup> SERDP partners with DOE and EPA as well as other Federal Agencies. This is a powerful partnership that could provide great unity of effort between the DoD services as well as adding interagency expertise in sustainability R&D. Part of the Army EQT strategy should be greater functional lines of communication with SERDP in order to better utilize its collaborative framework.

In addition, a key venue to advance the Army's sustainable technology efforts in the EQT strategy is the capacity of the newly established Center for the Advancement of Sustainability Innovations (CASI) within the Engineering, Research and Development Center (ERDC) of the Corps of Engineers at Champaign, Illinois. CASI has already initiated interservice coordination projects so there is great opportunity for CASI to expand collaboration with the Navy Research Lab in Washington DC, and the Air Force Research Lab at Wright Patterson. Both of those services are investing in efforts for power generation and fuel alternatives as well as tech transfer efforts that the Army could team with, particularly for rapid fielding options.

The Hadley QDR Report places specific emphasis on the success of the Rapid Equipping Force (REF) Initiative which inserted emerging technologies into contingency environments to meet an immediate operational need. The report recommends that this type of special process remain in place to continue to address urgent needs.<sup>54</sup> Using processes such as the REF for emerging energy and sustainability technology should be a key avenue for tech transfer. As Douglas Macgregor comments in his book *Transformation under Fire*,

“...the numbers of technologies and systems that may be worthy of consideration for rapid prototyping are still endless, and choices will have to be made. For the moment,

many technologies are not yet mature enough for widespread fielding. These include directed-energy weapons and non-fossil fuel energy sources such as fuel cell technology, but some of these can be selectively employed within the existing equipment mix to determine their proper use when they do mature. “<sup>55</sup>

A coordinated effort between the service labs seems the ideal synchronization point for such an effort.

The key to any pursuing any technology advancements is interest from the leadership. Status of potential technological developments should be briefed to leadership to provide visibility on the progress. An ideal forum for this information is the Capability Portfolio Reviews conducted by the VCSA on the major acquisition efforts.

#### Capability Portfolio Reviews (CPR) and Net Zero Vision

The VCSA initiated CPRs in December 2009 with the aim of “holistically examining, validating, modifying or recommending termination of requirements driving capability development, acquisition and sustainment across a series of portfolios defined by the Army but aligned to those defined by the Department of Defense (DoD).<sup>56</sup> These portfolios currently consist of the following 10 major systems:

- Precision Fires
- Air and Missile Defense
- Tactical Wheeled Vehicles
- Intelligence
- Surveillance and Reconnaissance
- Engineer Mobility and Counter Mobility
- Combat Vehicle Modernization
- Network Modernization
- Soldier Systems
- Aviation

This has been hugely successful in forcing coordination, identifying redundancy, and putting increased attention on senior leader priorities within the major programs. The

CPR effort was originally intended to be a one year cycle but based on the significant benefits of these reviews, Senior Army Leadership has recognized the need to continue the process. Moving forward, the configuration of the CPRs is under review with a potential to restructure the process from the systems listed above into additional portfolios that are organized into two categories: Operating Force Portfolios and Generating Force Portfolios. Under this proposal, energy concerns are captured under installation services portfolios in the Generating Force.<sup>57</sup> While this is certainly important, it will be critical to have operational energy be a consideration in the Operating Force portfolios should the process be reconfigured in that manner. Additionally, wherever ASA(ALT) engages in the CPR process, so too, should ASA(IE&E) in order to maintain consistent input on operational energy issues in the major acquisition efforts, particularly in the discussions of technology maturation and insertion.

As discussed earlier in the JCIDS portion, the formal implementation of an Energy Efficiency KPP will be of enormous benefit to all of the review processes, to include the CPRs. One of the primary goals of the CPR is to “Revalidate portfolios through an examination of combatant command operational needs, wartime lessons learned, Army Force Generation, emerging technologies, affordability, interest and opportunity.”<sup>58</sup> This is in complete alignment with the goals of the NetZero vision of the ASA(IE&E) which includes the following theme:

“In an era of persistent conflict, with a mission of stabilizing war-torn nations, a true stabilizing factor can be that of appropriate resource management. The Net Zero vision ensures that sustainable practices will be instilled and managed throughout the appropriate levels of the Army, while also maximizing operational capability, resource availability and well being.”<sup>59</sup>

## PART IV. RECOMMENDATIONS

- △ Insert language in the Army Programming Guidance (APGM) Annex A “Guidance to PEGs and Commands” consistent with the intent of the ASPG and APPG to clearly articulate the responsibility of the PEGs to actively ensure sustainability options are incorporated in the requirements justifications including Cost Benefit Analysis.
  
- △ Insert language in the Technical Guidance Memorandum (TGM) in the portion of “General Guidance” that is consistent with the added verbiage to the APGM (recommendation above) so that all PEGs understand their role in ensuring sustainable options are included in the development of analysis that come under their review.
  
- △ Ideally, add a subject matter expert from the ASA(IE&E) office to the PEG committees for Equipping, Training, Sustaining and Installations. At a minimum include the SME in the staffing of all Cost Benefit Analysis to ensure sustainable options were included in the course of action analysis.
  
- △ Add a scenario to the DASA CE Cost Benefit Analysis Training Course that demonstrates an example of non-quantifiable benefits of sustainability to promote greater awareness of the impacts.
  
- △ Add the Fully Burdened Cost of Fuel and Water tools as well as the FBC of Waste management tool to DASA CE Cost Benefit Analysis Guide under Appendix D “Cost Estimating Models and Tools”
  
- △ Incorporate FBCF in operational models throughout the Army in accordance with the MAESMO study recommendations.
  
- △ Expand the traditional Programmatic Environment, Safety, and Occupational Health (PESHE) templates used in the Acquisition process to increase emphasis on sustainability considerations.
  
- △ Fully implement the Energy Efficiency Key Performance Parameter within the JCIDS and the Defense Acquisition System.



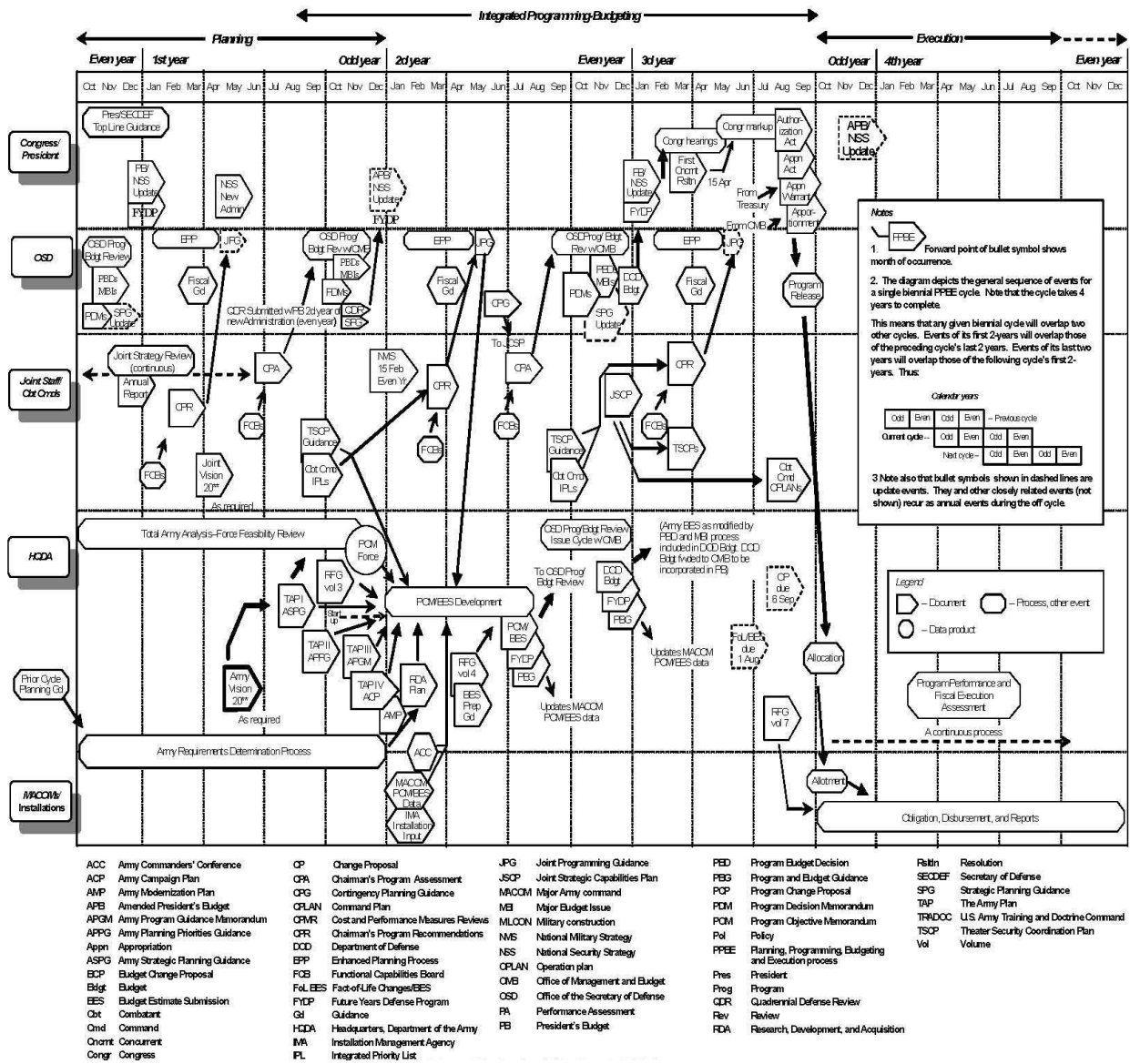
- △ Include language in Section M “Selection Criteria” of the Uniform Contract Format (UCF) for Requests for Proposals (RFPs) so that contractors make a deliberate effort to demonstrate progress toward sustainability goals as part of being selected in the bid process.
  
- △ Include a sustainability expert, for example a staff member with expertise on environmental and energy issues, on the transdisciplinary team that reviews contract packets and makes recommendations to the Selection Board or Selecting Official.
  
- △ Develop standardized templated language that PMs and contracting support agencies could readily access and insert in their contracts that address sustainability efforts consistent with both the EO 13514 and the FAR section 23.
  
- △ Insert sustainability language in the cASM tool to address contingency life support services and thus impact LOGCAP contracts and subcontracts.
  
- △ Leverage contractor R&D efforts to advance alternative energy, fuel efficiency and other sustainability initiatives by increasing the use of Value Engineering Change Proposal (VECP) options in their contracts.
  
- △ Refocus the Army Environmental Quality Technology (EQT) strategy to include increased emphasis on energy and interservice collaboration.
  
- △ Include review of technology maturation in the context of the Energy Efficiency KPP in the Capability Portfolio Reviews for all acquisition systems.
  
- △ Ensure the ASA(IE&E) is included in all the CPR decision making efforts alongside ASA(ALT).

## PART V. CONCLUSION

The need for sustainable weapons, equipment and life support services is unequivocal. Similarly, the desire from the field is undeniable. It is incumbent upon the staffs at every level but in particular those within the HQDA who are responsible for synthesizing and reviewing requirements to make sustainability a part of their consideration. This can be done in numerous ways within the existing framework of both PPBES and Acquisition. Further, it must be done within the existing funding lines, not pushed to the side until additional funding becomes available because that is an unrealistic timeframe and therefore an unacceptable approach. Our soldiers and counterparts in the field need this now and leadership needs to look at them with confidence and say their survivability is part of every equation and every decision. When the fiscal decisions are fully vetted, let it show that the most valuable return on investment is a sustainable security for our nation, our soldiers and the populations we deploy to assist.

*Back at your CSA desk, you instruct your PAO to let Ann know that indeed, the claims are accurate. The Army can roll with its current inventory to address each crisis and that your partnership with industry has successfully integrated the latest technology in the TWV for renewable energy. Further, you will brief the CJCS that the interoperability of the renewable fuel cells between the services and all the RC assets will ensure uninterrupted operations in Southwest US and Southeast Asia. Additionally, the humanitarian response units in AFRICOM will be able to transfer the equipment they deploy with to establish basic life support services off the grid. You briefly reflect back and are thankful for the efforts made during the 13 – 17 POM cycle to fully integrate the concept of sustainability when evaluating all budget requests. Finally, you gratefully realize that the delta achieved in 7 years with technology advancements has matched the foresight of the Army programmers in their investment strategies.*

# Appendix A: PPBES Process Chart



## Appendix B: Steps for the Cost Benefit Analysis Steps (DASA CE CBA Guide)

### Cost Benefit Analysis Steps – A Short Summary

#### 1. Develop the Problem Statement, Define the Objective and the Scope

*The problem statement clearly defines the problem, need, or opportunity that requires a solution and describes what the effort intends to accomplish.*

*The objective of the effort is to improve, reduce, or increase some aspect of a process, procedure, or program. Objectives should be measurable, realistic, achievable, and results – oriented. Simply put, objectives are measurable outcomes.*

*Scope defines the range of coverage by an initiative or proposal along specific dimensions like time, location, organization, technology or function.*

#### 2. Formulate Assumptions and Identify Constraints

*Assumptions are factors or conditions that are essential to the success of the solution and are beyond the control of the organization. Assumptions define the ground rules and accepted statements in order to limit the scope of the CBA. They are explicit statements of conditions on which the CBA is based.*

*Constraints usually refer to limits placed on resources to be devoted to the project. Constraints or barriers are beyond the control of the analyst and provide limitations within which analyses take place.*

#### 3. Document the Current State (the Status Quo)

*This defines and assesses the current state/condition. This should include a presentation of the estimate of costs associated with the status quo.*

*The status quo alternative of the CBA is the “baseline” program or system against which the costs and benefits of all feasible alternatives are compared.*

#### 4. Define Alternatives with Cost Estimates

*Alternatives are potential solutions to the problem statement which will be evaluated in the CBA.*

*Alternatives should reflect a review of the mission and strategic goals to verify that the alternative’s objectives are consistent with the problem statement.*

*A cost estimate captures the total cost of each alternative over its entire life cycle and is a summation of all relevant cost elements.*

#### 5. Identify Quantifiable and Non-Quantifiable Benefits

*Benefits are results expected in return for costs incurred for a chosen alternative. They are the quantitative and qualitative improvements expected or resulting from the implementation of an alternative.*

*Quantifiable benefits are benefits that can be assigned a numeric value such as dollars, physical count of tangible items or percentage change.*

*Non-quantifiable benefits are subjective in nature and can make a positive contribution to the analysis. Some examples of non-quantifiable benefits are improvement in morale and customer satisfaction.*

## Annex B: Steps for the Cost Benefit Analysis (continued)

### 6. Define Alternative Selection Criteria

*Alternative selection criteria are those standards/bases on which a decision will be based. CBAs must contain documentation that outlines decision criteria and identifies the extent to which each alternative satisfies each of the criteria.*

### 7. Compare Alternatives

#### a. Compare Costs and Benefits

*The essence of the CBA process is in comparing the costs and benefits of two or more alternatives (including the status quo) in order to select the preferred alternative.*

*As a general rule, the preferred alternative is the alternative that provides the greatest amount of benefits in relation to its cost.*

#### b. Define Trade-offs and Billpayers

*Trade-offs/billpayers are the funding sources that have been identified which will cover (partially or entirely) the costs of an alternative.*

#### c. Identify Second and Third Order Effects (Cause and effect)

*Second and third order effects are the results (consequences and/or impacts) stemming from a decision. They include the opportunity costs of pursuing one alternative over another. Second and third order effects identify what a decision maker can do or not do as a result of a decision.*

#### d. Perform Sensitivity Analysis and Risk Assessment

*Sensitivity analysis explains what the effect is on the cost/benefit model should assumptions change, risks become issues and /or dependencies not be met.*

*Risk assessment describes all risks that can impact the achievement of stated benefits or the cost of solving the business problem. Each risk has an associated mitigation strategy and an assessment of likelihood of occurrence.*

### 8. Report Results and Recommendations

*Results and recommendations summarize the findings of the analysis and make conclusive statements about the comparisons of alternatives.*

*The conclusions should demonstrate the cost/benefit relationships between each alternative.*

*The results address how the alternatives were ranked using the criteria developed in Step 6. Following a clear statement of the conclusions, there should be a firm recommendation regarding the preferred alternative.*

#### Identify Supporting Documentation

*All data and other information used in Steps 1-8 must be adequately documented. Supporting information should be identified so decision makers and analysts can understand how Steps 1-8 were developed.*

## Appendix C: Diagram of the Fully Burdened Cost of Waste in Contingency Ops

### Problem

Thousands of troops have deployed to Iraq and Afghanistan contingency bases for extended time periods, generating large amounts of solid, hazardous, and medical waste. All of this waste comes with costs:

- Monetary costs for disposal and treatment
- Potential effects to the health of troops stationed at these bases
- Potential health costs for the local residents due to residual waste or contamination
- Future liabilities and costs of damaged relations if waste is left untreated after base closures

However, the magnitude of these costs is unknown. There are few tracking mechanisms to measure the amount of waste generated in Theater, and no methods for analyzing the waste management costs. Waste management continues to be a missing piece in the life cycle of military operations. Additional knowledge about the Fully-Burdened Costs (FBC) of operations is needed, and previous Army Environmental Policy Institute (AEPI)-sponsored studies on the FBC of fuel and water were significant first steps. This study addressed the FBC of managing waste in contingency bases.



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# Appendix C: Diagram of the Fully Burdened Cost of Waste in Contingency Operations (continued)

## FULLY BURDENED COST OF WASTE IN CONTINGENCY OPERATIONS

### Objectives

- Build on lessons learned from recent deployments (Iraq and Afghanistan)
- Develop an analytical method for calculating the FBC of managing waste in contingency operations
- Ensure easy transfer of method to potential users and stakeholders
- Demonstrate the method using available, unclassified data and reasonable scenarios approved by the government

### Outcomes

- Microsoft® Excel®-based framework with open architecture that ensures wide compatibility and flexibility
- Documentation of all information sources and points of contact
- Detailed estimate for a base-case scenario
- Estimate of waste management costs impacts for two waste-reduction technologies

### Conclusions

Information about waste management in base camps was compiled from various data sources, including interviews with personnel in theater, subject matter experts, and published reports. The size and sophistication of the different types of base camps was considered. The cost estimating method was demonstrated through the analysis of two alternative technologies that are readily available for use in operations: Oil Change Alternative Technology (OilCAT) by Clarus Technology for recycling waste oil and Reverse Osmosis Water Purification Units (ROWPUs) to reduce bottled water waste.

- Lack of data is a major hindrance in estimating costs.
- Each location is unique; there are few standardized waste handling procedures.
- Full life cycle assessments are needed to understand the source of waste before it becomes waste.
- Magnitude of potential liabilities often pose technology may be significant.
- Demonstrations were inconclusive for program Air Force Base.
- Waste oil is typically re-used.
- Hazardous waste cost information is embedded in larger contract.

Base Case, Beqam Air Force Base Waste Generation and Disposal Outputs	Beqam Waste Generation	Beqam Waste Disposal Process
Solid Waste 36,420 tons per year	Recycling facility 15,825 tons per year Incinerator (at Curtin) 5,585 tons per year	18,982 tons per year Soil Storage in Pipeline 245,200,000 gallons per year Soil Storage in Pipeline 384,345,000 gallons per year
Biodegradable Waste 20,000 tons per year	Composting 384,345,000 gallons per year	20,000 tons per year Soil Storage in Pipeline 245,200,000 gallons per year Soil Storage in Pipeline 384,345,000 gallons per year
Hazardous Waste 2,207 tons per year	Medical Waste 59.4 tons per year	18,982 tons per year Soil Storage in Pipeline 245,200,000 gallons per year Soil Storage in Pipeline 384,345,000 gallons per year

### Alternative Technology Demonstrations



Fully Burdened Cost of Solid Waste Calculations (All Values for a 1-Year Period)

Cost Category	Base Case: Beqam	Beqam with Water Bottle Removal	Change
Solid Waste Infrastructure	\$ 6,411,956	\$ 6,360,247	-0.81%
Solid Waste Personnel	\$ 2,972,368	\$ 2,972,685	-0.89%
Solid Waste Transport and Equipment	\$ 408,450	\$ 401,030	-1.82%
Solid Waste Burial Closure	\$ -	\$ -	0.00%
Solid Waste Treatment and Cost of Solid Waste	\$ 9,348,774	\$ 9,138,961	-2.21%



Fully Burdened Cost of Used Oil at Beqam (All Values for a 1-Year Period)

Cost Category	Base Case: Beqam	Beqam with Oil CAT***	Change
Used Oil Infrastructure Costs	\$ 11,347	\$ 7,973	-30.00%
Used Oil Personnel	\$ 141,750	\$ 141,750	0.00%
Used Oil Transport and Equipment	\$ 1,422	\$ -	-100.00%
Revenue Category			
Used Oil and Used DMS*	?	\$ 207,480	2%
Used Oil burned for power**	?	\$ 207,480	7%
Used Oil Fuel burned in Incinerator***	\$ 207,480	\$ 207,480	0.00%
Fully Burdened Cost of Used Oil	\$ (92,961)	\$ (57,787)	9.11%

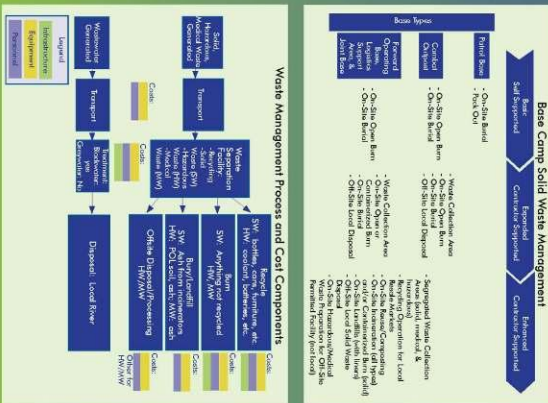
\* Solid fuel/High-Density Logistics Agency, Deposition Services - cost not available  
 \*\* Burned to generate power  
 \*\*\* Burned to generate power and not recommended by the manufacturer  
 \*\*\*\* Based on oil CAT and revenue in fuel vehicle and power generation equipment

### Recommendations

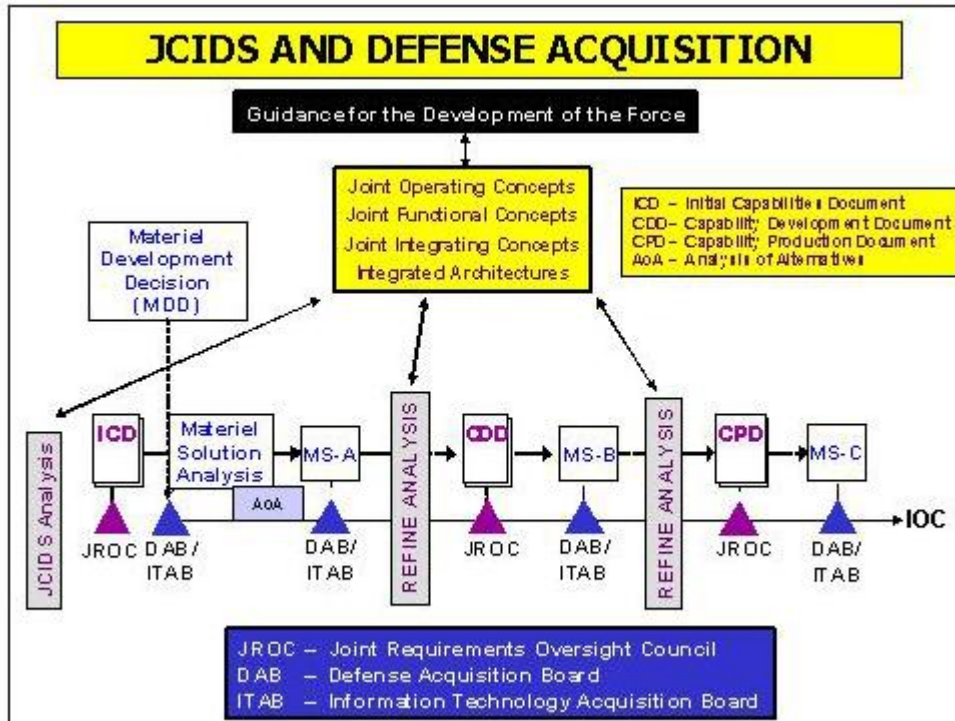
- Implement simple, cost-effective waste measurement tools to provide needed data.
- Implement simple, cost-effective waste measurement tools to influence behavior. What gets measured, matters.
- Combine cost data for the entire life cycle of material to provide the complete picture and focus efforts to reduce waste.
- Accurately document health and environmental liabilities for improved planning and decision making.
- Plan for waste management concurrently with other facility and infrastructure planning.

### Contacts

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# Appendix D: Joint Capability Integration Decision System (JCIDS) Process Chart





## Appendix E: Uniform Contract Format

### *Part I:*

- Section A Solicitation/Contract Form
- Section B Supplies or services and prices/costs
- Section C Description/specifications/statement of work
- Section D Packaging and marking
- Section E Inspection and acceptance
- Section F Deliveries or performance
- Section G Contract Administration Data
- Section H Special Contract requirements

### *Part II: Contract Clauses*

- Section I Contract Clauses

### *Part III: List of Documents, Exhibits, and Other Attachments*

- Section J List of attachments

### *Part IV: Representations and Instructions*

- Section K Representations, certifications, and other statements of offerors & respondents
- Section L Instructions, conditions, and notices to offerors or respondents
- Section M Evaluation factors for award

## Appendix F: Sample ESOH Contract Clauses (Excerpt from 2004 AEC PESHE Guidebook)

Note: These can and should be expanded to include sustainability goals

PESHE Development Guide  
US Army B-2 May 2004

### **Appendix B. Examples of ESOH Provisions Used in Contracting Documents**

#### **Instructions, Conditions, and Notices to Offerors (Section L)**

No later than 30 days prior to proposal receipt, you must provide the Contracting Officer with (a) an environmental assessment addressing all hazardous and/or toxic materials and fluids used in the Bid Samples, (b) a Safety Assessment and/or Hazard Assessment Report, and (c) a Material Safety Data Sheet (MSDS) pursuant to FAR 52.223-3 entitled "Hazardous Material Identification and Material Safety Data Sheets". In the event the above documentation is not provided to the Contracting Officer 30 days prior to proposal receipt, the anticipated 30-day evaluation of the Offeror's Bid Samples may be shortened, on a day for day basis, for each day the documentation was delinquenty provided. Under these circumstances, data to validate the written portion of the Offeror's proposal will not be collected on those days where no Bid Sample evaluation was conducted.

#### **Contract Clauses**

Federal Acquisition Regulation (FAR) Contract Clauses  
52.223-3 Hazardous Material Identification and Material Safety Data  
52.223-5 Pollution Prevention and Right-to-Know Information  
52.223-7 Notice of Radioactive Materials  
52.223-11 Ozone-Depleting Substances  
52.223-13 Certification of Toxic Chemical Release Reporting  
52.223-14 Toxic Chemical Release Reporting

Defense Federal Acquisition Regulation Supplement (DFARS) Contract Clauses  
252.223-7001 Hazard Warning Labels  
252.223-7002 Safety Precautions for Ammunition and Explosives  
252.223-7006 Prohibition on Storage and Disposal of Toxic and Hazardous Materials

#### **Statement of Work (SOW)**

A.1 **Environmental Compliance.** The contractor (and its subcontractors) shall comply with all federal, state, and local environmental laws, regulations, and policies for all activities defined in this SOW, whether conducted at government or contractor facilities. Upon request, the contractor shall make available to the government applicable environmental permits and documentation. The contractor shall be solely responsible for the management, cleanup, protection, and disposal of any and all emissions, effluents, wastes, and hazardous materials

Appendix F: Sample ESOH Contract Clauses (Excerpt from 2004 AEC PESHE Guidebook) continued

used in, generated by, or associated with the actions required by this SOW. The contractor shall report the current status and impacts to program cost, schedule, and performance from the above mentioned at each management review.

A.2 **Safety Engineering.** The contractor shall develop and implement a safety program that is integrated with the concurrent engineering process used to develop, mature, and support the system. The program shall address each system variant/configuration. The contractor shall use MIL-STD-882D in determining whether safety engineering objectives are met. As a minimum, the contractor shall do the following:

- a. Identify hazards associated with the system by conducting safety analyses and hazard evaluations. Analyses shall include both operational and maintenance aspects of each system variance
- b. Eliminate or reduce significant hazards by appropriate design or materiel selection. If hazards to personnel are not avoidable or eliminated, take steps to control or minimize those hazards.

A.3 **Safety Assessment Report (SAR).** The contractor shall develop and implement a SAR IAW the CDRL. The safety assessment shall identify all safety features and inherent hazards, and shall establish special procedures and/or precautions to be observed by test agencies and system users. The assessment shall address each system variant/configuration. As an appendix to the SAR, the contractor shall identify and incorporate Health Hazards associated with the system. The contractor shall provide a description and discussion of each potential or actual health hazard of concern for each subsystem or component. The following are examples of some areas of concern that may contain safety and health hazards. This is not an all-inclusive list:

- a. Fire protection issues
- b. Toxic fumes (i.e., engine exhaust, weapons firing)
- c. Noise levels (i.e., steady-state, impulse)
- d. Electrical issues
- e. Weapons characteristics (i.e., blast overpressure, misfire procedures, hangfire procedures, cook off, breech/barrel life, safety mechanisms, weapon/vehicle integration)
- f. Ammunition storage
- g. Operator's devices/procedures to ensure safe operation
- h. Analyses and tests conducted, with quantities involved, to demonstrate safety

A.4 **Radioactive Materials.** The contractor shall not use any radioactive materials without the approval of the Government. If any items furnished under this contract will contain Thorium, or other source material (see Title 10, Code of Federal Regulations, Part 40) in excess of 0.05 percent by weight or any other

Appendix F: Sample ESOH Contract Clauses (Excerpt from 2004 AEC PESHE Guidebook) (continued)

intentionally added radioactive material, the contractor shall provide a list to the Government for approval IAW the CDRL. If a Nuclear Regulatory Commission license is required, the contractor shall submit request for license within 30 days of contract award.

- A.5 **Health Hazards.** The contractor shall identify potential health hazards that are indigenous to and generated by the system, and eliminate or reduce such health hazards to an acceptable level as determined by the Government. Health hazards shall be reported as part of the SAR.
- A.6 **Hazardous Materials.** The contractor shall not use cadmium, hexavalent chromium, or other highly toxic or carcinogenic materials without Government approval. No Class I or Class II ODCs shall be used. The contractor shall not use materials that are identified in the Registry of Toxic Effects of Chemical Substances, published by the National Institute for Occupational Safety and Health, as materials that will produce toxic effects via the respiratory tract, eye, skin, or mouth. Moderately toxic materials may be used provided the design and control preclude personnel from being exposed to environments in excess of that specified in 29 CFR 1910, Occupational Safety and Health Standards.
- A.7 **Hazardous Materials Management Program/Plan.** The contractor shall establish, implement and maintain a Hazardous Materials Management Program using National Aerospace Standard 411, *Hazardous Material Management Program*, as a guide. The contractor shall develop a Hazardous Materials Management Plan which, at a minimum, shall identify and describe the organizational relationships and responsibilities for eliminating hazardous materials, define the process used to identify the hazardous materials utilized in the manufacturing process and establish prioritization criteria for ranking the relative risks of these hazardous materials.
- A.8 **Pollution Prevention Program/Plan.** The contractor shall establish a Pollution Prevention Plan to minimize program environmental and cost impacts and ensure that all pollution that cannot be prevented will be recycled or disposed of in an environmentally safe manner. The contractor shall define the process they will use to identify the pollution prevention initiatives which will eliminate hazardous materials in the performance of the contract. The Plan shall describe the analysis techniques that will be used to evaluate the risks associated with identified nonhazardous material/process substitutes to ensure no detriment to performance. The Plan shall include the contractor's process for materials/processes selection and evaluation. The contractor shall define their overall process for assigning responsibility to analyze and document the potential costs associated with trading a hazardous material for a less hazardous material over the life cycle of the product. A trade-off analysis is required as part

Appendix F: Sample ESOH Contract Clauses (Excerpt from 2004 AEC PESHE Guidebook) (continued)

of the Hazardous Materials Management Program to determine the availability of substitute materials and the feasibility of using them based on cost, schedule, performance requirements, and associated risk impacts to the system's development.

- A.9 **Material Safety Data Sheet.** The contractor shall provide a Material Safety Data Sheet (MSDS) for each hazardous material item, without a National Stock Number, procured under this contract (IAW the CDRL). If applicable, a copy of the MSDS shall be submitted with each affected Special Group item. Content of MSDS shall be in accordance with Occupational Safety and Health Act (OSHA) 1910.1200(g) and annotated onto the contractor MSDS format.
- A.10 **Environmental Planning Report.** The contractor shall consider environmental effects and trade-offs at all levels of planning and test hardware development. Appropriate environmental considerations shall be implemented by establishing environmental objectives and performance criteria. These objectives and criteria shall be developed with consideration of constraints including but not limited to federal, state, and local environmental laws, regulations, and guidelines; environmental resource management; and cumulative environmental effects. The contractor shall use best commercial practices in documenting these considerations. How they relate to the overall program shall also be included in an Environmental Planning Report (IAW the CDRL).
- A.11 **Support for National Environmental Policy Act (NEPA) Compliance.** If data is needed by the government to develop applicable environmental analysis required under provisions of the NEPA, the contractor shall provide a description of proposed contractor actions along with qualitative and quantitative data describing the constituent materials, emissions, effluents, wastes, and hazardous materials used in and produced from these activities.

**Contract Data Requirements List (CDRL)**

- A016 Safety Assessment Report (draft report due 150 days after contract award)
- A017 Radioactive Materials (due 60 days after contract award)
- A018 Hazardous Materials Management Report (initial report due 240 days after contract award)
- A025 Material Safety Data Sheet (as required with each hazardous material item)
- A027 Environmental Planning Report (due 90 days after contract award)

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