



**A MODEL TO GUIDE DEVELOPMENT OF ENVIRONMENTAL FINAL  
GOVERNING STANDARDS FOR OVERSEAS UNITED STATES  
DEPARTMENT OF DEFENSE INSTALLATIONS**

Sean R. Marshall, Captain, USAF

AFIT-GEM-ENV-14-M-37

**DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY**

***AIR FORCE INSTITUTE OF TECHNOLOGY***

---

**Wright-Patterson Air Force Base, Ohio**

DISTRIBUTION STATEMENT A.  
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the United States Government. This material is declared a work of the United States Government and is not subject to copyright protection in the United States.

AFIT-GEM-ENV-14-M-37

**A MODEL TO GUIDE DEVELOPMENT OF ENVIRONMENTAL FINAL  
GOVERNING STANDARDS FOR OVERSEAS DEPARTMENT OF DEFENSE  
INSTALLATIONS**

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Engineering Management

Sean R. Marshall, B.S.E.

Captain, USAF

March 2014

DISTRIBUTION STATEMENT A.  
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

**A MODEL TO GUIDE DEVELOPMENT OF ENVIRONMENTAL FINAL  
GOVERNING STANDARDS FOR OVERSEAS UNITED STATES  
DEPARTMENT OF DEFENSE INSTALLATIONS**

Sean R. Marshall, B.S.E.  
Captain, USAF

Approved:

//signed//  
\_\_\_\_\_  
Willie Harper, PhD (Chairman)

27 February 2014  
Date

//signed//  
\_\_\_\_\_  
Mark Goltz, PhD (Member)

27 February 2014  
Date

//signed//  
\_\_\_\_\_  
Steve Schuldt, Capt, USAF, P.E. (Member)

3 March 2014  
Date

//signed//  
\_\_\_\_\_  
Alfred E. Thal Jr., PhD (Member)

27 February 2014  
Date

## **Abstract**

The Overseas Environmental Baseline Guidance Document (OEBGD) establishes the baseline environmental standards for United States (U.S.) forces operating overseas and is the template for the development of Environmental Final Governing Standards (FGS). FGS are required at any long-term U.S. installation and set the standard of environmental compliance for U.S. forces in each individual country. The purpose of this research is to analyze the FGS of different countries and compare their requirements to the OEBGD requirements. The individual FGS were scored according to if sections were more stringent, less stringent or the same as the OEBGD. The countries analyzed were then plotted in a model of environmental performance and governance called the Lester Model. The Lester Model categorizes the countries according to their environmental performance and governance scores. While the results did not indicate that a country's position in the Lester Model has a strong relationship with the overall strictness of the FGS, the analysis did identify a number of mistakes in the FGS. The mistakes found ranged from spelling errors to formatting mistakes to inconsistent references.

*To my wonderful girlfriend who helped me through this and my classmates who made my time at AFIT all the more enjoyable.*

## **Acknowledgments**

A big thanks to the environmental offices in EUCOM, CENTCOM, and PACOM that provided me with the documents I needed in a quick and timely manner. Without your help, I would not have been able to complete this research.

Sean R. Marshall

## Table of Contents

	Page
Abstract.....	iv
Acknowledgments.....	vi
Table of Contents.....	vii
List of Figures.....	ix
List of Tables.....	x
I. Introduction.....	1
Background.....	1
Research Objectives.....	3
Methodology.....	3
Assumptions/Limitations.....	4
Preview.....	4
II. Literature Review.....	6
Lester Model.....	6
Environmental Federalism and U.S. military bases.....	8
Environmental Performance Index.....	9
World Governance Indicators.....	15
Summary.....	18
III. Methodology.....	19
Lester Model Construction.....	19
OEBGD and FGS Comparisons.....	20
Summary.....	26
IV. Analysis and Results.....	27
Lester Model.....	27
Belgium.....	29
Germany.....	29
Italy.....	30
Japan.....	30
Kuwait.....	31
Netherlands.....	31
Sultanate of Oman.....	33

Portugal .....	33
State of Qatar.....	34
Kingdom of Saudi Arabia .....	34
Republic of Korea .....	35
Spain.....	36
Republic of Turkey .....	37
United Arab Emirates.....	37
United Kingdom.....	38
Air Emissions Chapter Comparisons .....	38
Drinking Water Chapter Comparisons.....	39
Wastewater Chapter Comparisons .....	41
Hazardous Materials Chapter Comparisons.....	43
Hazardous Waste Chapter Comparisons.....	45
Solid Waste Chapter Comparisons.....	47
Petroleum, Oil, and Lubricants Chapter Comparisons .....	48
Analysis.....	50
Summary .....	53
V. Conclusions and Recommendations .....	54
Chapter Overview .....	54
Review of Findings .....	54
Significance of Research.....	55
Recommendations for Future Research .....	58
Summary .....	58
Appendix A – OEBGD and FGS Comparisons.....	59
Bibliography .....	103

## List of Figures

	Page
Figure 1. Lester Model plot for countries in this analysis .....	28
Figure 2. FGS Scores by Country .....	50
Figure 3. Correlation plot between EPI and FGS Scores.....	51
Figure 4. Correlation plot between WGI and FGS Scores.....	52

## List of Tables

	Page
Table 1. Lester Model states by category .....	7
Table 2. List of EPI indicators and weights .....	14
Table 3. Breakdown of Lester Model Construction.....	20
Table 4. Breakdown of OEBGD section comparisons .....	21
Table 5. Lester Model .....	27
Table 6. Air Emissions chapter comparisons.....	39
Table 7. Drinking Water chapter comparisons .....	41
Table 8. Wastewater chapter comparisons.....	43
Table 9. Hazardous Materials chapter comparisons .....	44
Table 10. Hazardous Waste chapter comparisons .....	46
Table 11. Solid Waste chapter comparisons .....	48
Table 12. Petroleum, Oil, and Lubricants chapter comparisons .....	49
Table 13. Table of Asia-Pacific Countries without existing FGS .....	57

# **A MODEL TO GUIDE DEVELOPMENT OF ENVIRONMENTAL FINAL GOVERNING STANDARDS FOR OVERSEAS UNITED STATES DEPARTMENT OF DEFENSE INSTALLATIONS**

## **I. Introduction**

When establishing long-term overseas installations, the Department of Defense (DoD) must establish Environmental Final Governing Standards (FGS) with the host nation that sets the standard for environmental compliance that the United States (U.S.) must follow. The document that sets the minimum standard for environmental compliance for U.S. military forces overseas is the Overseas Environmental Baseline Guidance Document (OEBGD), DoD Instruction 4715.05-G. The OEBGD's purpose is to provide criteria and management procedures for developing country-specific FGS and to establish standards for U.S. forces in countries for which a FGS does not exist (Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, 2007). The OEBGD is supposed to establish the minimum requirements for environmental compliance at overseas installations. Environmental Executive Agents (EEA) are the parties who have been delegated the responsibility to enforce and establish FGS for each individual country.

## **Background**

In an address to the Australian Parliament, President Barack Obama (2011) announced that the U.S. would be refocusing on the Asia Pacific region of the world. With the war effort in Afghanistan and Iraq decreasing, the U.S. would be shifting its attention to the countries along the Pacific Ocean. This shift to the Asia Pacific region means that there will be an increased U.S. military presence in the region. In a 2012 speech at the Shangri-La Security Dialogue, former Secretary of Defense Leon Panetta (2012) further emphasized that the U.S. focus on the

Asia Pacific region. He also spoke of expanding alliances and increasing military cooperation with other nations along the Pacific Ocean. This expanding involvement of U.S. military forces in the Asia Pacific region means that U.S. forces will also need new locations to operate from. If the U.S. military establishes new footprints in countries with which there are no current installations, the U.S. will need to draft new FGS.

A previously unpublished research paper studied the differences between the FGS for Japan, Republic of Korea, and Germany and how each FGS differed from each other and the OEBGD (Baker, Murley, & Pickenpaugh, 2012). The authors believed that the differences in FGS must be tied to each government's economic and environmental policies and used the Environmental Performance Index, a composite index of environmental data, to try and describe why each country scored as they did. They concluded that countries with stronger environmental policies would have more stringent FGS and that U.S. forces overseas would be required to follow increased environmental requirements (Baker et al, 2012).

This research effort is to further expand on Baker, Murley, and Pickenpaugh's (Baker et al, 2012) results by studying more of the environmental agreements that the U.S. has with other countries by comparing more FGS to the OEBGD. In addition to comparing the FGS, the countries will be categorized using an adaption of a model of state environmental commitment and institutional capability developed by Lester (Lester, 1994). To adapt Lester's model to countries, the Environmental Performance Index was used to represent a country's environmental commitment and performance and the World Governance Indicators were used to represent a country's institutional capability.

## **Research Objectives**

The objective of this research is to discover if a country's position in the Lester Model is indicative of how strict the FGS is or would be for countries that do not have a FGS. Reviewing the FGS will also determine if there are any FGS that have less stringent requirements than the OEBGD, as the OEBGD should be the minimum standard for all criteria. An analysis of the different FGS may also highlight any areas of concern that environmental policy makers should be aware of.

## **Methodology**

Following the research of Baker, Murley, and Pickenpauh, seven chapters of the OEBGD were used to analyze the different FGS. Those selected chapters were Chapter 2 – Air Emissions, Chapter 3 – Drinking Water, Chapter 4 – Wastewater, Chapter 5 – Hazardous Materials, Chapter 6 – Hazardous Waste, Chapter 7 – Solid Waste, and Chapter 9 – Petroleum, Oil, and Lubricants. To compare the OEBGD and the different FGS, the OEBGD was divided into subject areas according to the subchapter headings. The FGS were then scored according to whether the requirements in each subject area were more stringent, had the same, or less stringent than the OEBGD. The countries were then categorized by the Lester Model using the Environmental Performance Index (EPI) and the World Governance Indicators (WGI) as measures for environmental performance and institutional capacity, respectively. A methodology was developed to score the FGS relative to the OEBGD, and an analysis conducted to determine if the FGS score was correlated to the Lester Model category. The scores of the FGS were compared within these categories to determine if the countries in each category scored similarly.

## **Assumptions/Limitations**

This analysis was based upon several limitations and assumptions that allowed for the construction of the Lester Model and the analysis of the Final Governing Standards. The OEBGD is over 5 years old and was last updated in 2007. This could mean that its standards and procedures are out of date. The different FGS are not all from the same year but this research uses the 2012 EPI and WGI data to determine placement in the Lester Model. While the WGI is updated every year, the EPI is only updated every couple of years with 2012 being the most recent update. It was then assumed that the differences between the countries' most current environmental and governance scores would be similar enough to the years that the FGS were written to compare them to the Lester Model. Spain and Turkey's FGS are over 5 years old and the only FGS that have not been updated since 2010. While this is not a problem comparing them to the 2007 OEBGD, it may cause errors when using the 2012 EPI and WGI data.

It was decided to use the WGI and EPI to build the Lester Model because they are publicly available and regularly updated, peer-reviewed databases that measure governance and environmental performance. To construct the Lester Model, it was assumed that the EPI and WGI were good measures of a country's environmental commitment and institutional capacity, respectively. Because the Lester Model construct uses point estimates to categorize the countries, it ignored the standard errors in the EPI and WGI. The EPI also does not have sufficient data to give scores to all countries, including some countries with which the U.S. has an FGS.

## **Preview**

The remainder of this thesis is divided into four chapters. Chapter 2 contains a literature review of the tools used in this research. Chapter 3 discusses the methodology used in this

research. Chapter 4 will review the findings of this research for each country and then for each chapter of the OEBGD. Chapter 5 will discuss the outcome of this research and any future research opportunities.

## **II. Literature Review**

This chapter provides an overview of applicable literature related to this research and is divided into three sections. This first section describes the original Lester Model. The second chapter describes how the Lester Model was applied to the environmental compliance requirements of United States (U.S.) military installations in the continental U.S. The next section describes the Environmental Performance Index and its construction. It also highlights the limitations and criticisms of the Environmental Performance Index. The last section describes the World Governance Indicators and its construction, as well as its major criticisms.

### **Lester Model**

The 1970s and 1980s saw a gradual decline in the power of the federal government and a push to strengthen the power of the states during the presidencies of Nixon, Reagan, and Bush (Lester, 1994). While the federal government had traditionally been the driving force and funding source behind environmental laws and enforcement, the federalist policies of the 1970s and 1980s gave much of that power back to the states. There were many in government and academia that argued that states were more effective at implementing and enforcing environmental policies because of their proximity to the problem (Lester, 1994). In response to the federal cuts to environmental regulation, the states would have to figure out their own way to enforce and fund environmental regulation. The federal government sets minimum levels of regulations and it is up to the states to decide if the minimum is sufficient or if further regulation is required.

According to Lester (1994), a state's response to the decentralization of federal environmental programs is a function of that state government's institutional capacity and the

state's commitment to environmental protection. Lester's model (1994) for the categorization of American states by their commitment to good environmental policies and the institutional capabilities of their individual state governments is hereafter referred to as the Lester Model. The Lester Model groups states into four categories: Progressives, Strugglers, Delayers, and Regressives. The Progressives category represents states that have strong institutional capabilities and a strong commitment to environmental protection. The Strugglers category represents states with weak institutional capabilities and a strong commitment to environmental protection. The Delayers category represents states with strong institutional capabilities and a low commitment to environmental protection. The Regressives category represents states with weak institutional capabilities and a low commitment to environmental protection. Table 1 shows the breakdown of the 50 states into the four categories of the Lester Model. To build his model, Lester used a state environmental performance model called the Green Index and a model of state government capability designed by Bowman and Kearney (1998) of the University of South Carolina.

Table 1. Lester Model states by category

<b>Progressives</b>	<b>Strugglers</b>	<b>Delayers</b>	<b>Regressives</b>
California	Colorado	Alabama	Arizona
Florida	Connecticut	Alaska	Indiana
Maryland	Delaware	Arkansas	Kansas
Massachusetts	Hawaii	Georgia	Kentucky
Michigan	Idaho	Illinois	Mississippi
New Jersey	Iowa	Louisiana	Nebraska
New York	Maine	Missouri	New Mexico
Oregon	Minnesota	Ohio	South Dakota
Washington	Montana	Oklahoma	Utah
Wisconsin	Nevada	Pennsylvania	Wyoming
	New Hampshire	South Carolina	
	North Carolina	Tennessee	
	North Dakota	Texas	
	Rhode Island	Virginia	
	Vermont	West Virginia	

## **Environmental Federalism and U.S. military bases**

In response to the Lester Model, Smith (1997) surveyed environmental offices at military installations in a state in each of the four categories. His objective was to determine if the experiences of the environmental compliance personnel assigned to these installations matched the expected environmental requirements and enforcement from the Lester Model categories. The states and installations Smith (1997) focused on were California (Travis Air Force Base), Colorado (Fort Carson and Air Force Academy), Oklahoma (Fort Sill and Altus Air Force Base), and Wyoming (F.E. Warren Air Force Base). Overall, he concluded that the installations' experiences with the state environmental requirements were consistent with the Lester Model classifications.

In California, the military environmental offices saw increased regulatory and enforcement action, as one might expect from a state within the Progressives category. The local environmental agencies added additional requirements to the baseline federal standards and were fairly stringent in their enforcement of said policies (Smith, 1997). In several instances, California's enforcement agencies tried to enforce policies on the installation for which they had no authority and had to be overridden by the federal government (Smith, 1997). In Colorado, both Fort Carson and the Air Force Academy experienced environmental regulation as expected from the Strugglers category. The state of Colorado was forced to divert resources to air quality because the cities of Denver and Colorado Springs were in air quality nonattainment areas and thus did not have the proper personnel to adequately manage its entire environmental compliance program. The military environmental offices in Colorado claimed that the state would try to develop and enforce blanket stringent standards and group the installations with other heavily polluted sites in the state because it lacked the capacity to adequately manage its hazardous

waste program (Smith, 1997). The environmental offices at F.E. Warren, which has some sites in Colorado, also claimed that the enforcement in Colorado was much tougher than enforcement in the state of Wyoming.

In Oklahoma, Fort Sill and Altus Air Force Base experienced environmental regulation as was to be expected from a state in the Delayers category. The two installations have very good relationships with the state environmental agencies and characterized them as “active and able” (Smith, 1997). The state environmental offices were willing and able to enforce the minimum federal regulations but did not advocate anything beyond that (Smith, 1997). In Wyoming, the F.E. Warren Air Force Base environmental office experienced relatively minimum environmental enforcement as expected from a state in the Regressive category. The state enforced federal standards but with no perceived stringency, with the exception of groundwater. The state also sought input from the installation when drafting enforcement standards. As mentioned above, the environmental office at F.E. Warren claimed that enforcement at sites in Colorado was much more stringent than any enforcement in Wyoming (Smith, 1997).

### **Environmental Performance Index**

In the early 2000s, the United Nations (UN) convened a gathering of world leaders in an event called the Millennium Summit to discuss the role of the UN in the next century (United Nations, 2000). Part of the UN declaration was for countries to make every effort to adopt sustainable development practices and protect the environment. Unfortunately, there were no metrics to measure how countries were meeting goals in comparison to other countries around the world. In response to the need for quantitative measurements of environmental performance, the Yale Center for Environmental Law and Policy (YCELP) and the Center for Earth Information Science Information Network (CIESIN) at Columbia University developed the

Environmental Sustainability Index (ESI) in 2000 in conjunction with the World Economic Forum (WEF) and the Joint Research Centre, European Commission (Emerson et al., 2012; Etsy, Levy, Srebotnjak, & de Sherbinin, 2005). The object of the ESI was to “provide science-based quantitative metrics as an aid to achieving long-term sustainable development goals” (Emerson et al., 2012) and was designed to counter the use of GDP as a measure to compare countries. The creators of the ESI sought to create a measuring system with a broader, more policy-oriented emphasis that attempts to capture everything from natural resource endowments to pollution rates to institutional mechanisms for change (Etsy et al, 2005)

The last iteration of the ESI in 2005 used 76 individual data sets to develop 21 indicators of environmental sustainability to score countries in five categories: environmental systems, reducing environmental stresses, reducing human vulnerability to environmental stresses, societal and institutional capacity to respond to environmental challenges, and global stewardship (Etsy et al, 2005). The indicators were chosen after a review of the available science and literature as well as through discussions with experts in the fields of environmental science, governmental policy, and business. These indicators were intended to be applicable across varying political and societal boundaries and to be easily quantifiable and scale-neutral, but lack of adequate data and incomplete sources of information resulted in data gaps and limitations (Etsy, Levy, Srebotnjak, & de Sherbinin, 2005). Even though the authors endeavored to do their best to use only the best quality data in the ESI, they acknowledged that the ESI is not perfect but an iterative tool that “helps to identify the leaders and laggards with regard to a broad range of environmental issues” (Etsy et al, 2005).

As the first major attempt at a comprehensive environmental ranking of countries, the ESI received criticism from the scientific community for trying to simplify the complex nature of

environmental science. Criticisms have ranged from simple disagreements with parts of the methodology (Jha & Murthy, 2003) to accusing the ESI of using misleading data to make “dirty nations look clean” (Keeping Score, 2001). The ESI has been accused of making top member countries of the WEF look cleaner and more sustainable through data manipulation and improper indicator weighting (Keeping Score, 2001; Morse & Fraser, 2005). A large number of the ESI indicators are normalized by using population, GDP, or per capita, which gives richer and more populated nations an advantage over smaller nations that may pollute less but also have significantly smaller populations and economies. The Social and Institutional Capacity and the Global Stewardship components favor rich and powerful nations because the ESI assumes that the capacity to protect the environment is the same as actually doing things to protect the environment (Keeping Score, 2001). These two components have variables that are unfairly slanted towards countries with larger economies and infrastructure that participate in multinational agreements.

In 2006, the ESI was renamed the Environmental Performance Index (EPI) and focused “on a narrower set of environmental issues for which governments can be held accountable” (Emerson et al., 2012). The 2012 EPI is the latest iteration of the EPI series and includes a Pilot Trend EPI which tracks and ranks countries according to their EPI and ESI scores over the last decade. The creators of the EPI acknowledge that there are still problems with the data collection due to the nature of some of the indicators and that individual indicators may favor certain countries over others; however, they believe that the close correlation with GDP lends support to the validity of the EPI (Emerson et al., 2012). The 2012 EPI uses 22 indicators of environmental performance, listed in Table 2, separated into ten categories that must meet the criteria of relevance, performance orientation, established scientific methodology, data quality,

time series availability, and completeness (Emerson et al., 2012). The range for each indicator is calculated as the difference between the target score and the score of the worst performer.

Targets are calculated from a number of sources including treaties, international standards, national regulatory requirements, expert judgment, and time series analysis (Emerson et al., 2012). The score for each country is then calculated by using the difference between the range and that country's distance from the target (e.g., range is 100% - 5% = 95% access to sanitation and country's access to sanitation is 65% so the difference is  $95 - 65 = 30$ ) and then normalizing it against the range of the indicator for a proximity-to-target score (Emerson et al., 2012).

Many of the criticisms of the ESI also hold true for the EPI. While the EPI has a different purpose and less variables, the overall structure of the EPI is very similar to the ESI. The respective 30% and 70% weightings for the Environmental Health (EH) and Environmental Vitality (EV) categories is to compensate for the fact that the EH category has a much higher correlation with the overall EPI scores than the EV category (Emerson et al., 2012). The authors of the EPI claim to use this arbitrary 30/70 ratio to prevent countries with high EH scores but low EV scores from having high EPI scores. The 30/70 ratio essentially forces the EV objective to play a higher part in the EPI scoring. The individual indicators were given weights based upon expert judgments or data quality rather than how much the indicators actually contributed to the overall score (Emerson et al., 2012). The EPI report makes no mention of standard errors in the final overall EPI score and assumes no deviation in the final score.

The EPI has been used in literature as a proxy for measuring the environmental performance of countries. The following examples are recent uses of the EPI in research. Bernauer and Boehmelt (2013) believe that societies have more economic freedoms and stronger welfare systems also have stronger environmental policies and therefore, better environmental

performance. They used the EPI as one of the variables in their model to determine if these “kinder” societies had better environmental performance. In their research, they tested their variables against the components of the EPI to see where social policy had the more significant effects on the EPI components. The results implied that these societies with stronger social policies had positive effects on the EH component of the EPI, but a weaker effect on EV.

Hershfield, Bang, and Weber (2013) used the EPI to measure if the age of a country was correlated with the environmental performance of that country. The authors defined the age of a country as the point at which the existing form of government began or since gaining independence. Their results indicated that the country age accounted for approximately 6% of the variation in the country’s environmental performance.

Vachon (2012) used the EPI to test whether countries that had higher technological and innovation capacity also had better environmental performance scores. Vachon’s hypothesis was that countries with higher technological capacity had corporations that were adopting new technologies that were more eco-efficient and that would have a positive effect on the country’s environmental performance. Vachon concluded that there technological capacity is positively linked to environmental performance, but as corporations get more efficient at production they also tend to produce more, so technological capacity was negatively linked to carbon footprint.

Table 2. List of EPI indicators and weights

Objectives	Category	Category Weight	Indicator	Indicator Weight
<b>Environmental Health (30%)</b>	Air pollution (effects on human health)	7.5%	Indoor air pollution	3.75%
			Particulate matter	3.75%
	Water (effects on human health)	7.5%	Access to drinking water	3.75%
			Access to sanitation	3.75%
	Environmental health	15%	Child mortality	15%
<b>Ecosystem Vitality (70%)</b>	Air pollution (effects on ecosystem)	8.75%	Sulfur dioxide emissions per capita	4.38%
			Sulfur dioxide emissions per GDP	4.38%
	Water (effects on ecosystem)	8.75%	Change in water quality	8.75%
	Biodiversity and habitat	17.5%	Biome protection	8.75%
			Marine protection	4.38%
			Critical habitat protection	4.38%
	Forests	5.83%	Forest loss	1.94%
			Forest cover change	1.94%
			Growing stock change	1.94%
	Fisheries	5.83%	Coastal shelf fishing pressure	2.92%
			Fish stocks overexploited	2.92%
	Agriculture	5.83%	Agricultural subsidies	3.89%
			Pesticide regulation	1.94%
	Climate change and energy	17.5%	Carbon dioxide emissions per capita	6.13%
			Carbon dioxide emissions per GDP	6.13%
			Carbon dioxide emissions per electricity generation	2.63%
			Renewable energy	2.63%

## World Governance Indicators

Similar to the ESI, the World Governance Indicators (WGI) project was created to put numerical values to subjective data and create a metric to measure something that is difficult to define, much less measure. Instead of environmental performance or sustainability, the WGI is an attempt to “score” nations around the world according to different aspects of governance. The WGI is a research project of The World Bank’s Macroeconomics and Growth Team that rates governments across six broad dimensions of governance (Kaufmann, Kraay, & Mastruzzi, 2010):

1. **Voice and Accountability** – perceptions of the extent to which a country’s citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
2. **Political Stability and Absence of Violence/Terrorism** – perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.
3. **Government Effectiveness** – perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government’s commitment to such policies.
4. **Regulatory Quality** – perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promotes private sector development.
5. **Rule of Law** – perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
6. **Control of Corruption** – perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private interests.

The 31 data sources used to score countries include surveys and subjective assessments from a variety of sources including commercial entities, non-governmental organizations (NGOs), and other organizations that capture perceptions of the six dimensions of governance (Kaufmann, Kraay, & Mastruzzi, 2010). The survey and assessments are compiled for each country for each

dimension of governance and scored. The different data sources are then combined using a statistical tool called the unobserved components model (UCM) (Kaufmann, Kraay, & Mastruzzi, 2010). Each country's score in the six categories is then normalized between -2.5 and 2.5, with larger numbers representing a better score. For each dimension of governance, the WGI gives each country a percentile rank based upon that dimension's score. Unlike the EPI, the WGI includes the standard error in the point estimate and the 90% confidence upper and lower bounds for each ranking.

A major criticism of the WGI is that they do not actually measure how well a country's government performs but rather the perception of how well the government performs in each dimension (Thomas, 2010). The WGI authors acknowledge this is a problem, but their counter argument is that the respondents are often experts in the specific governments they monitor and many of them have first-hand experience in dealing with the governments (Kaufmann, Kraay, & Mastruzzi, 2010). The data sources used to construct the WGI all use their own methodology and are organizations with differing objectives and biases. To combat the problems with using multiple unstandardized data sources, the WGI uses margins of error in their measurements to help compensate for the fact that the data they are using are "imperfect proxies" to measure something that is inherently difficult to measure (Kaufmann, Kraay, & Mastruzzi, 2010). A problem with using perceptions to measure governance is that many of the data sources may have incorrect perceptions and biases as to what constitutes good governance (Langbein & Knack, 2010), but the WGI authors claim there when the results and demographics of the data sources are studied there is no statistical significance to the claim of biases (Kaufmann, Kraay, & Mastruzzi, 2010).

Another criticism of the WGI is that the six dimensions of governance do not accurately represent what they intend to represent. According to Thomas (2010), the clustering of the variables is not based on research and evidence but assumptions and biases of the WGI authors. Thomas (2010) also claims that because of the way the WGI is constructed, it lacks construct validity. The six dimensions of governance are supposed to represent six discreet aspects of a country's governance but in reality they may be multiple observations of a single underlying concept. Langbein and Knack (2010) tested the six dimensions of the WGI using exploratory factor analysis, path analysis, and confirmatory factor analysis to test this theory. Their analysis showed that instead of six distinct factors, there was a single dominant factor. They concluded that the six dimensions were actually measuring the same underlying concept of governance.

The following are some examples of the WGI use as a proxy for the governance of countries. Hershfield et al (2013) also used the WGI as a control variable in their research that was described in the previous section. They averaged the composite scores of the WGI to create a composite score because of the collinearity between the six dimensions. Lio and Liu (2008) used the WGI to develop a model to determine if there was a link between agricultural productivity and the governance of a country. To aggregate the six dimensions of the WGI into a single variable, they originally used a principal components analysis to determine the weighting of the six dimensions but found that it gave them a very similar result as giving each component an equal weighting. The results from their model showed that countries with better governance yielded better agricultural production if all other factors were equal. The WGI has also been used in the literature when comparing countries on a limited basis to explain differences between geographical neighbors (Kwon, 2013; Ragasa et al, 2013)

## **Summary**

This chapter reviewed the development of the Lester Model and its application to the U.S. military. It also covered the construction and issues pertaining to the EPI and the WGI. As mentioned in the previous sections, both the EPI and the WGI have their limitations but can be useful when comparing countries across difficult subjects such as environmental performance and governance. The original construction of the Lester Model is not applicable outside of the U.S. so a new Lester Model is required in order to compare and categorize foreign countries.

### III. Methodology

This chapter discusses the methods used to complete this research. The first section contains information on creating the Lester Model from the raw WGI and EPI data and building the four categories. The following section then describes the methodology used to compare and score the FGS. The comparisons are based upon the baseline requirements and subject areas of the OEBGD.

#### Lester Model Construction

To get a singular score of governance for each country, the mean of the six WGI scores were used in the initial model construction. This gave equal weight to each of the indicators as fundamental factors of governance. Principal Components Analysis was not used to determine variable weights in my model as the model assumes that all the factors are equally important and as discussed in the previous chapter, may all measure the same concept of governance. As with the previous studies mention in Chapter 2, this research will use the equal-weighting, or average, of the six dimensions of the WGI. This model ignores the standard errors associated with each individual country score and instead only uses the point estimate for the analysis and model construction.

To ensure that all the data was on the same scale and easily compared, the raw numbers from the EPI and WGI were normalized by scaling from 0 to 1 using the following equation:

$$X = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}} \quad (1)$$

Where:

$X_i$  = raw data value for country  $i$

$X_{min}$  = raw minimum value of data set  
 $X_{max}$  = raw maximum value of data set

The four quadrants of the Lester Model were created using the normalized EPI and WGI scores. The WGI values were placed on the x-axis and EPI values were placed on the y-axis.

Table 3 shows the division points for each of the quadrants.

Table 3. Breakdown of Lester Model Construction

Category	EPI and WGI break points
Progressive	$1 \geq WGI > 0.5$ and $1 \geq EPI > 0.5$
Strugglers	$0 \leq WGI \leq 0.5$ and $1 \geq EPI > 0.5$
Delayers	$1 \geq WGI > 0.5$ and $0 \leq EPI \leq 0.5$
Regressives	$0 \leq WGI \leq 0.5$ and $0 \leq EPI \leq 0.5$

### OEBGD and FGS Comparisons

There are two U.S. Government websites that maintain copies of the FGS, the DoD Environment, Safety and Occupational Health Network and Information Exchange (DENIX) and FedCenter.gov website. Both websites are controlled U.S. Government websites and require a need to access or a Common Access Card (CAC) to view and download the files. In the event that the data either website is incorrect or missing, the DoD overseas environmental offices responsible for compliance should have the most updated information and copies of the FGS.

The basic design of the FGS mirrors very closely, the layout of the OEBGD. While the FGS should have country-specific information and requirements, they all follow the same format and design of the OEBGD. Only the Spain FGS (discussed further in Chapter 4) has a slightly different chapter arrangement but the data is still comparable to the OEBGD. **Error! Reference**

**source not found.** shows the applicable subject areas and the corresponding OEBGD sections used when comparing the different FGS and the OEBGD. With a few exceptions, most of the subject areas consist of one 3-number subheading and all of the subparagraphs under that subheading. The subject areas that contain more than one subheading or multiple subheadings were an attempt to place like sections into the same subject area to reduce the amount of scored areas to a reasonable level. The subject area of *Record Keeping Requirements* in Hazardous Wastes chapter lists one subsection but applies to any mention of recordkeeping in the Hazardous Wastes chapter.

Table 4. Breakdown of OEBGD section comparisons

<b>Scored Subject</b>	<b>OEBGD sections</b>
<b>Chapter 2 - Air Emissions</b>	
Steam/Hot Water Generating Units	2.3.1
Incinerators	2.3.2
Perchloroethylene (PCE) Dry Cleaning Machines	2.3.3
Chromium Electroplating and Chromium Anodizing Tanks	2.3.4
Halogenated Solvent Cleaning Machines	2.3.5
Units Containing O-zone Depleting Substances (ODS)	2.3.6
Motor Vehicles	2.3.7
Stack Heights	2.3.8
<b>Chapter 3 - Drinking Water</b>	
System	3.3.1, 3.3.2.8, 3.3.2.9, 3.3.2.10, 3.3.2.11, 3.3.3, 3.3.4
Total Coliform Bacteria Requirements	3.3.2.1
Inorganic Chemical Requirements	3.3.2.2
Fluoride Requirements	3.3.2.3

Lead and Copper Requirements	3.3.2.4
Synthetic Organics Requirements	3.3.2.5
Disinfectant/Disinfection Byproducts (DDBP) Requirements	3.3.2.6
Radionuclide Requirements	3.3.2.7
Chapter 4 - Wastewater	
Effluent Limitations for Direct Dischargers of Conventional Pollutants	4.3.1
Effluent Limitations for Non-Categorical Industrial Indirect Dischargers	4.3.2
Effluent Limitations for Categorical Industrial Dischargers (Direct or Indirect)	4.3.3
Storm Water Management	4.3.4
Septic System	4.3.5
Sludge Disposal	4.3.6
Chapter 5 - Hazardous Materials	
Storage and Handling	5.3.1
Dispensing Areas	5.3.2
Shipment/Transportation	5.3.3
Master Listing	5.3.4
Labeling (MSDS)	5.3.5, 5.3.6, 5.3.7
Hazardous Material Management	5.3.8, 5.3.9, 5.3.10, 5.3.11
Chapter 6 - Hazardous Waste	
DoD Hazardous Waste Generators	6.3.1
Hazardous Waste Accumulation Point (HWAP)	6.3.2
Hazardous Waste Storage Area (HWSA)	6.3.3
Use and Management of Containers	6.3.4
Record Keeping Requirements	6.3.5
Contingency Plan	6.3.6
Tank Systems	6.3.7

Standards for the Management of Used Oil and Lead-Acid Batteries	6.3.8
Hazardous Waste Training	6.3.9
Hazardous Waste Disposal	6.3.10
Chapter 7 - Solid Waste	
Solid Waste Management Plan	7.3.1, 7.3.2, 7.3.3, 7.3.4, 7.3.5, 7.3.6, 7.3.7, 7.3.8, 7.3.9
New Municipal Solid Waste Landfills	7.3.10, 7.3.11
Municipal Solid Waste Landfill Operation	7.3.12
Open Burning	7.3.13
Composting Operations	7.3.14
Composting Usage	7.3.15
Chapter 9 - Petroleum, Oil, and Lubricants	
General POL Storage Container Criteria	9.3.2
Additional POL Storage Container Criteria	9.3.3
Storage Container Wastes	9.3.4
General Transport and Distribution Criteria	9.3.5
Personnel Training	9.3.6

The Drinking Water chapter of the OEBGD is divided into the individual testing sub-sections. The subsection of the chapter on testing is substantial and it was required to split it into the individual sub-sections to accurately show the comparisons. The *System* subject area captures the information in section 3.3.1, with the exception of the individual testing requirements, as well as four sub-sections: *Surface Water Treatment Requirements*, *Non-Public Water Systems*, *Alternative Water Supplies* and *Filter Backwash Requirements*. These four sub-sections were included into “System” because none of them address limits of contaminants or chemicals in the water.

The Hazardous Materials chapter has two scored subject areas with multiple OEBGD sections because those sections contain related information that can be compiled into a single subject area. The sections in the *Labeling (MSDS)* subject area all pertain to the use of Material Safety Data Sheets (MSDS). The sections in the *Hazardous Material Management* subject area contain the last four sections of Chapter 5 in the OEBGD and consist of generic use and management of hazardous materials. The *Solid Waste Management Plan* subject area in the Solid Waste Chapter contains nine sections that are all related to an installation's solid waste management plan. The *New Municipal Solid Waste Landfills (MSWL)* subject covers two sections of the OEBGD that reference plans for new landfills. These sections were combined into similar subject areas to simplify the analysis and reduce unnecessary and redundant subject areas.

The Final Governing Standards were scored according to how they compared to the baseline standards in the OEBGD. Each chapter and subject area of the OEBGD was compared with each FGS to determine whether or not they were more or less stringent. The chapter heading was given a score of 1 if it had additional sections that were not in the OEBGD or a zero if it had no additional sections. If a chapter was missing sections, the section score receives a zero, not the chapter heading score. This score is only to capture if there are additional country requirements that are not identified in the OEBGD.

The subject areas are only scored with a 1, 0, or -1, regardless of how much more stringent or less stringent the FGS is than the OEBGD. The tables referenced in each subject area also count towards the score for that subject area. Areas that had the same or similar requirements as the OEBGD receive a 0. Areas did not score a point if they specified what

regulations, manuals, instructions, etc., where the OEBCGD says to use applicable regulations and Host Nation (HN) agreements and did not mention any further requirements or restrictions.

Each subject area that was more stringent or had additional requirements was scored with a 1. Some examples of more stringent requirements are stricter maximum contaminant levels (MCL) of chemicals, stricter emission standards, stricter control limits, greater minimum separation distances, prohibited actions, and specified minimum requirements not identified in the OEBCGD. Examples of additional requirements include, but are not limited to, additional regional requirements within a country, additional criteria, or additional monitoring.

Additionally, the FGS would use words that conveyed mandatory action such as shall, will, must, etc., which would give the subject area a higher score if the OEBCGD had no such requirement.

Words that conveyed a best practice but not mandatory such as should, can, may, etc., were not considered to be more stringent than the OEBCGD. Conversely, any subject area that was less stringent or had less requirements than the OEBCGD was scored with a -1. Areas would receive a score of -1 if they had less strict MCL standards or were missing sections that were in the OEBCGD. A negative score is assigned even if the FGS says to contact HN authorities but lists no or less criteria for the subject area. The rationale behind this is that if there was an agreement or treaty prohibiting an activity, the FGS should identify it. In the event of a subject area having both negative and positive scores, the area should be assigned a score that properly indicates whether the FGS is intending to be more or less stringent than the OEBCGD. In one example (explained in the Republic of Korea section of the Results), the FGS does not have a monitoring requirement for populations larger than 10,000 but has stricter monitoring requirements for all other populations which makes it score higher than the OEBCGD.

## **Summary**

This chapter summarized the methodology used in the comparison of FGS and the OEBGD and the construction of the Lester Model with the WGI and EPI. This research will use two publicly available and peer-reviewed indices to construct the Lester Model in order to compare foreign governments. The different FGS were compared according to subject areas from the OEBGD and scored according to the methodology outlined in this section.

## IV. Analysis and Results

This chapter discusses the results of the OEBGD and FGS comparisons and the construction of the Lester Model. The first section discusses the Lester Model product. The following sections go into a further analysis of how each country fits in the Lester Model and provide an explanation of any negative scores. This analysis will then discuss relevant findings by each OEBGD chapter. The results showed a high level of compliance across all of the countries and none of the FGS were overall less stringent than the OEBGD. While the Lester Model did not produce results as predicted, this chapter will also address the prediction capability of the research model.

### Lester Model

Table 5 shows how the countries used in this analysis fall into the Lester Model. Fifteen different FGS were used in this comparison and more than half of those countries fall into the Progressives category. Unfortunately, none of the countries fall into the Strugglers category, but the Kingdom of Saudi Arabia is very close to the division between the Strugglers and Regressives categories.

Table 5. Lester Model

Progressives	Strugglers	Delayers	Regressives
Belgium Germany Italy Japan Netherlands Portugal Republic of Korea Spain United Kingdom	(none)	Sultanate of Oman State of Qatar United Arab Emirates	Kuwait Kingdom of Saudi Arabia Republic of Turkey

Figure 1 is the Lester Model plot of all the countries used in this analysis. The six countries in the Delayers and Regressives categories are clustered in one area of the Lester Model as they all fall near the dividing line between the Delayers and Regressives. The following sections will discuss the FGS by country and as well as give an overview of the results of each chapter.

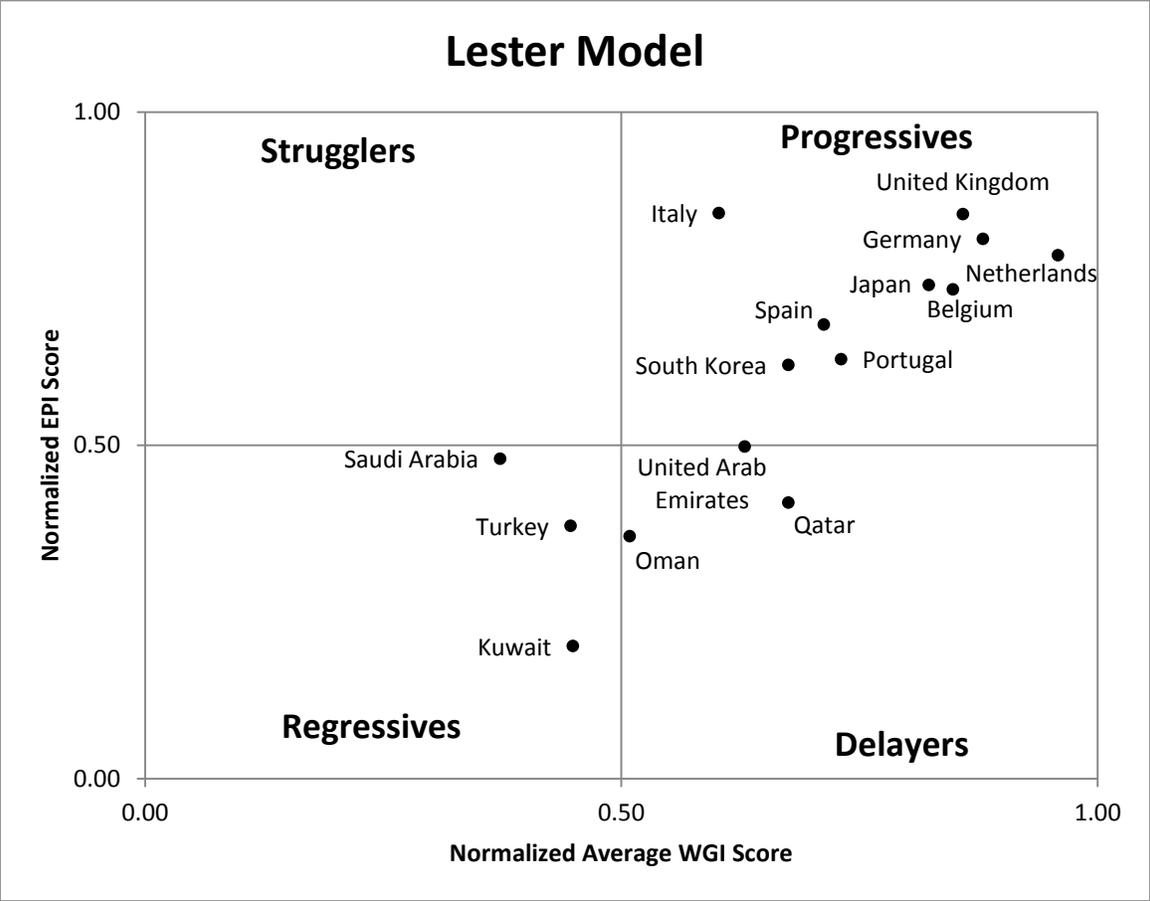


Figure 1. Lester Model plot for countries in this analysis

## **Belgium**

Belgium is in the Progressive category with an EPI score of 63.02 and an average WGI score of 1.34. The FGS identifies the US Army Installation Command, Europe Region (IMCOM-Europe) as the EEA. The Belgium FGS's last complete update was in May 2010 with revisions to Chapter 10 made in July 2012 (United States Army: Installation Management Command - Europe, 2010a).

The FGS had a final score of 20 with the same requirements as the OEBGD in 28 areas, higher scores in 24 areas, and scores lower in 4 areas. The four areas that the FGS scores negative in are Chapter 2 – *Incinerators*, Chapter 6 – *Hazardous Waste Storage Area* and *Hazardous Waste Disposal*, and Chapter 9 – *General POL Storage Container Criteria*. The FGS does not have any criteria for incinerators and only states that the installation should contact the EEA for additional information. The *Hazardous Waste Storage Area* of the FGS received a negative score because it does not mention testing and maintenance of equipment. The *Hazardous Waste Disposal* section does not have a section on ignitable, reactive, or incompatible wastes as contained in the OEBGD. In Chapter 9, the FGS does not have any criteria on containment area floor maximum permeability.

## **Germany**

Germany is in the Progressives category with an EPI score of 66.91 and an average WGI score of 1.45. The FGS identifies the U.S. Army IMCOM-Europe as the EEA. The Germany FGS's last complete update was made in February 2010 with revisions made in Chapters 10 and 13 made in July 2012 (United States Army: Installation Management Command - Europe, 2010b). The FGS had a final score of 33 with the same requirements as the OEBGD in twenty-three areas and higher scores in thirty-three areas. There were no negative scores and the FGS is

overall much more stringent than the OEBGD and has additional criteria for different areas of the country.

## **Italy**

Italy is in the Progressive category with an EPI score of 68.9 and an average WGI score of 0.48. The FGS identifies the Commander Navy Region Europe Africa Southwest Asia (CNREURAFSWA) as the EEA. The Italy FGS was last updated and revalidated in September 2012 (Commander, Navy Region Europe, Africa, Southwest Asia, 2012).

The FGS final score was 28 with same requirements as the OEBGD in twenty-four areas, higher scores in thirty areas, and scores lower in two areas. Italy has two sections that score negative and they are the two sections that have to do with landfills: Chapter 7 – *New Municipal Solid Waste Landfills* and *Municipal Solid Waste Landfill Operation*. The Italy FGS doesn't have the same amount of criteria as the OEBGD for landfill requirements. The Italy FGS has waste chapters that are completely different from any of the other FGS. The FGS classifies waste into two categories based upon its origin, urban or special, and then further divides these two categories into non-hazardous and hazardous waste (Commander, Navy Region Europe, Africa, Southwest Asia, 2012). This classification makes the FGS different from any of the other FGS studied and makes it very difficult to compare the two chapters with the OEBGD.

## **Japan**

Japan is in the Progressives category with an EPI score of 63.36 and an average WGI score of 1.25. The FGS identifies the Commander, U.S. Forces Japan (COMUSJAPAN) as the EEA. The Japan FGS was last updated and revalidated in Dec 2012 (Headquarters, U.S. Forces Japan, 2012). The FGS final score was 13 with the same requirements as the OEBGD in 43

areas and higher scores in 13 areas. Japan had scored the lowest of all the Progressives and second lowest of all the countries but had no negative scores.

## **Kuwait**

Kuwait is in the Regressive category with an EPI score of 35.54 and an average WGI score of -0.06. The FGS identifies U.S. Central Command (USCENTCOM) as the EEA. The Kuwait FGS was last updated in March 2011 (United States Army Central Command, 2011).

The FGS final score was 14 with the same requirements as the OEBGD in forty-two areas and higher scores in 14 areas. There were also three errors found in the FGS, two in Chapter 2 – Drinking Water and one in Chapter 6 – Hazardous Waste. Firstly, the *Fluoride Requirements* section states that the content of fluoride in the drinking water shouldn't exceed 4 mg/L as stated in Table C3.T3 of the FGS, but Table C3.T3 has the MCL of fluoride as 1.5 mg/L (United States Army Central Command, 2011). Secondly, the title for the table for synthetic organic compounds limits has a header that repeats the heading for Table C3.T5. Also in the same table, the MCL for Di (2-ethylhexyl) adipate is stated as "0." and is missing numbers after the decimal point (United States Army Central Command, 2011). The third mistake is an inconsistency between two sections of Chapter 6. Under the *DoD Hazardous Waste Generators* section, subparagraph C6.3.1.3. states that shippers of hazardous waste must keep manifests for a minimum of five years, but the *Recordkeeping Requirements* section states that manifests will be retained for three years (United States Army Central Command, 2011).

## **Netherlands**

The Netherlands is in the Progressives category with an EPI score of 65.65 and an average WGI score of 1.72. The FGS identifies U.S. Army IMCOM-Europe as the EEA. The

Netherlands FGS's last complete update was in May 2010 with revisions made to Chapter 10 in July 2012 (United States Army: Installation Management Command - Europe, 2010c).

The FGS final score was 21 with the same requirements as the OEBGD in thirty-one areas, higher scores in twenty-three areas, and lower scores in two areas. The two negative scores were Chapter 2 – *Incinerators* and Chapter 6 – *Hazardous Waste Disposal*. As with Belgium, the Netherlands FGS doesn't contain standards for incinerators but states that installations should contact the EEA. The standards for hazardous waste land disposal are not outlined in the FGS but it states that hazardous wastes will only be land-disposed in landfills approved by Dutch authorities and the hazardous waste incinerator standards section in the FGS do not list all the requirements as the OEBGD (United States Army: Installation Management Command - Europe, 2010c).

In addition to the two negative scores, four mistakes were found in the Netherlands FGS. The first mistake is in section C2.3.9. *Fluorinated Greenhouse Gases* and is the error statement "Error! Reference source not found." This is likely meant to reference Table C2.T1 Fluorinated Greenhouse Gases as it is the only table pertaining to fluorinated greenhouse gases after the chapter. The next mistake is the same mistake in the *Fluoride Requirements* as the Kuwait FGS. The Netherlands FGS states that the MCL is 4 mg/L and references Table C3.T17 but that table shows the MCL of fluoride to be 1.1 mg/L. The third mistake is in section C4.3.2.1 *Effluent Limits* and references non-existent paragraphs. The mistake is likely the result of deleting the referencing mistake in the OEBGD but the paragraph references were not completely deleted so the FGS states "see subparagraphs C4.3.3.1.8., 0., and 0. for a list of categorical standards" (United States Army: Installation Management Command - Europe, 2010c). The fourth mistake found was a spelling error where the FGS spells "terratogen" instead of teratogen.

## **Sultanate of Oman**

The Sultanate of Oman (Oman) is in the Delayers category with an EPI score of 44 and an average WGI score of 0.15. The Oman FGS does not identify an EEA but states that U.S. Air Forces Central (USAFCENT) is the Lead Environmental Component for Oman. The FGS was last updated in December 2012 (U.S. Air Forces Central, 2012). The FGS final score was 20 with the same requirements as the OEBGD in thirty-six areas and higher scores in twenty areas. Oman's WGI score places it just over the dividing line between Regressives and Delayers but Oman's score of 20 makes it more likely that Oman does not belong in the Regressive category.

Although there were not negative scores, there were four mistakes found in the Oman FGS. The first mistake was again the discrepancy between the fluoride MCL in the text and in the tables. The text of the *Fluoride Requirements* section puts the MCL at 4 mg/L but referenced Table C3.T3 sets the MCL for fluoride at 1.5 mg/L. The second mistake is the same error found in the OEBGD in C4.3.2.1 *Effluent Limits* where the FGS references subparagraphs that do not exist. The third mistake is a typing error in section C6.3.10.8.1.3 *Biodegradation*. The FGS states "11W being biodegraded" instead of "HW being biodegraded." The fourth mistake is in the FGS table of contents and is likely a formatting mistake. The C1.1. PURPOSE header has text from that section incorrectly formatted in the style of the section header and the word processing program automatically populated that text in the table of contents (U.S. Air Forces Central, 2012).

## **Portugal**

Portugal is in the Progressives category with an EPI score of 57.64 and an average WGI of 0.93. The FGS identifies the Deputy Commander of U.S. Air Forces Europe (USAFE/CV) as

the EEA but authority is delegated to the USAFE Civil Engineer for all matters except for the duty to approve waivers to the FGS (Headquarters, United States Air Forces Europe, 2011).

The FGS final score was 26 with the same requirements as the OEBGD in twenty-six areas, higher scores in twenty-eight areas, and lower scores in two areas. The two negative scores were Chapter 2 – *Motor Vehicles* and Chapter 6 – *Hazardous Waste Disposal*. The Portugal FGS omits the section on the emissions of motor vehicles in Chapter 2. In Chapter 6, the FGS omits the sections in Chapter 6 of the OEBGD on treatment technologies to reduce the volume or hazardous characteristics of waste and also does not have criteria for hazardous waste landfills and only states that waste may only be disposed of in permitted landfills (Headquarters, United States Air Forces Europe, 2011).

### **State of Qatar**

The State of Qatar (Qatar) is in the Delayers category with an EPI score of 46.59 and an average WGI score of 0.73. The Qatar FGS does not identify any party as the EEA or Lead Environmental Component but the FGS was prepared by USAFCENT on behalf of USCENCOM. The Qatar FGS was last updated in March 2011 (U.S. Air Forces Central, 2011). The FGS final score was 17 with the same requirements as the OEBGD in thirty-nine areas and higher scores in seventeen areas.

### **Kingdom of Saudi Arabia**

The Kingdom of Saudi Arabia (KSA) is in the Regressives category with an EPI score of 49.97 and an average WGI score of -0.33. The KSA FGS does not identify any party as the EEA or Lead Environmental Component but the FGS was prepared by USAFCENT on behalf of USCENCOM. The FGS was last updated in December 2010.

The FGS final score was 20 with the same requirements as the OEBGD in thirty-six areas and higher scores in twenty areas. While there were no negatives in the KSA FGS, there was one error found. In Chapter 5 – Hazardous Materials, the end of the chapter has an incorrect numbering sequence. The bulleted numbers jump from “5.4.2.5” to “5.4.6”, when it should go to “5.4.3” (U.S. Air Forces Central, 2010). The KSA plots in the Lester Model very close to the dividing line between Strugglers and Regressives and could very easily be in the Strugglers category. While only point estimates are used in this study, the margin of error on the EPI score could mean that the KSA should be in the Strugglers category and its FGS score of 20 lends credibility to that assumption

### **Republic of Korea**

The Republic of Korea (ROK) is in the Progressives category with an EPI score of 57.2 and an average WGI score of 0.73. The FGS identifies the Commander of U.S. Forces Korea (USFK) as the EEA although the EEA responsibilities have been delegated to the USFK Assistant Chief of Staff Engineer. The FGS was last updated in June 2012.

The FGS final score was 21 with the same requirements as the OEBGD in thirty-three areas, higher scores in twenty-two areas, and a lower score in one area. The negative score is because the ROK FGS does not identify necessary coliform monitoring requirements for populations greater than 50,000 while the OEBGD continues to list requirements for larger populations. In addition, the FGS doesn't have requirements for monitoring of lead and copper in populations greater than 100,000 but its additional requirements for populations under 100,000 made it score higher than the OEBGD. Also of concern are the criteria for effluent limitations in Chapter 4. While the FGS has additional requirements not in the OEBGD, the FGS does not state whether the limitations are not to exceed the concentration or if the concentration is

monthly and weekly averages as they are in the OEBGD (Headquarters, United States Forces Korea, 2012).

## **Spain**

Spain is in the Progressives category with an EPI score of 60.31 and an average WGI score of 0.86. The FGS identifies the Commander in Chief of U.S. Naval Forces Europe (CINCUSNAVEUR) as the EEA. The Spain FGS was last updated in July 2008 and no new FGS has been published as of this research even though the Spain FGS states that the EEA will update and revalidate the FGS at least every two years (Commander, Navy Region Europe, 2008).

The FGS final score was 32 with the same requirements as the OEBGD in thirty-six areas, higher scores in sixteen areas, and lower scores in four areas. The four areas with negative scores are Chapter 2 – *Stack Heights*, Chapter 3 – *Disinfectant/Disinfection Byproducts (DDBP) Requirements*, and Chapter 9 – *Additional POL Storage Criteria and Personnel Training*. The FGS makes no mention of stack heights or personnel training. Spain’s general POL criteria have more requirements than the OEBGD but it does not address the subsections in the OEBGD’s section “Additional POL Storage Criteria.” The FGS has a less stringent MCL for total trihalomethanes of 0.10 mg/L as opposed to the OEBGD MCL of 0.08 mg/L and does not address any of the other disinfectants specified in the OEBGD. In addition to the negative scores, one mistake was found in the FGS. Section C7.3 *Solid Waste Management Strategy* lists three Spanish goals for waste reduction but two of the goals list the same target date with different total reduction amounts (Commander, Navy Region Europe, 2008).

## **Republic of Turkey**

The Republic of Turkey (Turkey) is in the Regressives category with an EPI score of 44.8 and an average WGI score of -0.07. The FGS does not specifically identify the EEA but it can be implied from the title page that the Headquarters (HQ) USAFE is the EEA. The Turkey FGS was last updated in July 2008.

The FGS final score was 1 with the same requirements as the OEBGD in fifty-five areas and a higher score in one. The only difference between the OEBGD requirements and the FGS was an additional section called *Hazardous Waste Minimization* that required installations to develop and use plans to reduce the amount of hazardous waste transported. The FGS and the OEBGD were almost word for word identical and that also meant that the FGS has the same mistake as the OEBGD in section C4.3.2.1 in which it references subparagraphs that do not exist.

## **United Arab Emirates**

The United Arab Emirates (UAE) is in the Delayers category with an EPI score of 50.91 and an average WGI score of 0.57. The FGS identifies USCENTCOM as the EEA and CNREURAFSWA as the Lead Environmental Component. The UAE FGS was last updated in March 2012. The FGS final score was 34 with the same requirements as the OEBGD in twenty-two areas and higher scores in thirty-four areas. The UAE point estimate is right on the edge between the Progressives and Delayers category and with the margin of error in the EPI score, the UAE could just as easily be in the Progressives category. The UAE FGS had the highest score of all the countries in this analysis and that lends credibility to the notion that perhaps the UAE should be a Progressive instead of a Delayer.

## **United Kingdom**

The United Kingdom (UK) is in the Progressives category with an EPI score of 68.82 and an average WGI score of 1.37. The FGS identifies HQ USAFE/CV as the EEA for Portugal. The FGS was last updated in March 2013.

The FGS final score was 32 with the same requirements as the OEBGD in twenty-four areas and higher scores in thirty-two areas. While there are no negative scores, there was one mistake found in the FGS. In Table C2.T3 Emission Standards for Incinerators, the FGS mistakenly has “955” instead of “95%” for the amount reduction of hydrogen chloride in existing units with a rated at greater than 250 tons per day (Headquarters, United States Air Forces Europe, 2013). There are also eight sections of the UK FGS that don't necessarily have stricter requirements than the OEBGD but require that installations contact local authorities to determine if there are any stricter requirements than specified in the FGS. These sections were given a higher score than the OEBGD because these sections in the OEBGD make no mention of contacting host nation authorities to determine stricter requirements.

## **Air Emissions Chapter Comparisons**

Table 6 shows the breakdown in points for each of the countries and subject areas in the Air Emissions chapter. The Air Emissions comparisons had 60 total instances where the FGS had a more stringent or additional requirements than the OEBGD. The countries in the Progressive category had an average score of 4.89, the Delayers had an average score of 3, and the Regressives had an average score of 1. 13 of the 15 countries had additional criteria and sections that were not in the OEBGD. There were several subjects that appeared in multiple FGS but are not in the OEBGD and they are ambient air quality standards, volatile organic compounds (VOC) limits, and motor vehicle filling stations emissions.

Table 6. Air Emissions chapter comparisons

	<b>Air Emissions</b>	<b>Steam/Hot Water Generating Units</b>	<b>Incinerators</b>	<b>PCE Dry Cleaning Machines</b>	<b>Chromium Electroplating and Chromium Anodizing Tanks</b>	<b>Halogenated Solvent Cleaning Machines</b>	<b>Units containing ODS</b>	<b>Motor Vehicles</b>	<b>Stack Heights</b>	<b>Total</b>
Belgium	+	0	-	+	0	+	+	+	+	<b>5</b>
Germany	+	+	0	0	0	+	+	+	+	<b>6</b>
Italy	0	+	+	0	0	0	+	+	0	<b>4</b>
Japan	+	+	+	0	0	0	0	0	0	<b>3</b>
Kuwait	+	0	0	0	0	0	0	0	0	<b>1</b>
Netherlands	+	+	-	+	0	0	+	+	0	<b>4</b>
Oman	+	0	0	0	0	0	0	0	0	<b>1</b>
Portugal	+	+	+	+	0	+	+	-	0	<b>5</b>
Qatar	+	0	0	0	0	0	0	0	0	<b>1</b>
Republic of Korea	+	0	+	+	0	0	+	+	0	<b>5</b>
Saudi Arabia	+	+	0	0	0	0	0	0	0	<b>2</b>
Spain	+	+	+	0	0	+	+	+	-	<b>5</b>
Turkey	0	0	0	0	0	0	0	0	0	<b>0</b>
United Arab Emirates	+	+	+	0	+	0	+	+	+	<b>7</b>
United Kingdom	+	+	+	+	+	+	+	0	0	<b>7</b>
<i>Total</i>	<b>13</b>	<b>9</b>	<b>5</b>	<b>5</b>	<b>2</b>	<b>5</b>	<b>9</b>	<b>6</b>	<b>2</b>	

### Drinking Water Chapter Comparisons

Table 7 shows the breakdown in points for each of the countries and subject areas in the Drinking Water chapter. This chapter had 75 instances of FGS being more stringent or having

additional requirements than the OEBGD. The Progressives average score was 4.78, the Delayers average score was 6.67, and the Regressives average score was 3.33. The Drinking Water chapter had the most instances of positive scores of all the chapters in this study. The top three areas of scoring were (in order) *Inorganic Chemical Requirements*, *Synthetic Organics Requirements*, and *System*. Eight of the FGS had additional sections or requirements that were not identified in the OEBGD. There were only two subjects that were in multiple FGS and they were other water quality-related criteria and permitting required for using bodies of water. Oman, Qatar, and KSA have an additional section on other drinking water properties but the KSA FGS has much more criteria than Oman and Qatar. Spain and Germany require installations acquire permits before using water bodies as sources of drinking water. The scores in this chapter were somewhat unexpected with Qatar, KSA, Oman, and UAE scoring higher than all of the other countries with the exception of Italy, which scored the highest.

Table 7. Drinking Water chapter comparisons

	<b>Drinking Water</b>	<b>System</b>	<b>Total Coliform Bacteria Requirements</b>	<b>Inorganic Chemical Requirements</b>	<b>Fluoride Requirements</b>	<b>Lead and Copper Requirements</b>	<b>Synthetic Organics Requirement</b>	<b>Disinfectant/Disinfection Byproducts Requirements</b>	<b>Radionuclide Requirements</b>	<i>Total</i>
Belgium	+	<b>S</b>	<b>S</b>	+	+	+	+	+	<b>S</b>	6
Germany	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	+	<b>S</b>	<b>S</b>	3
Italy	+	+	+	+	+	<b>S</b>	+	+	+	8
Japan	<b>S</b>	<b>S</b>	<b>S</b>	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	1
Kuwait	<b>S</b>	<b>S</b>	<b>S</b>	+	<b>S</b>	+	+	<b>S</b>	<b>S</b>	3
Netherlands	<b>S</b>	+	<b>S</b>	+	<b>S</b>	<b>S</b>	+	<b>S</b>	<b>S</b>	3
Oman	+	+	+	+	<b>S</b>	<b>S</b>	+	+	+	7
Portugal	<b>S</b>	+	+	+	+	<b>S</b>	+	<b>S</b>	+	6
Qatar	<b>S</b>	+	<b>S</b>	+	+	<b>S</b>	+	+	+	6
Republic of Korea	<b>S</b>	+	-	+	+	+	<b>S</b>	<b>S</b>	+	4
Saudi Arabia	+	+	<b>S</b>	+	+	<b>S</b>	+	+	+	7
Spain	+	+	+	+	+	<b>S</b>	+	-	+	6
Turkey	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
United Arab Emirates	+	+	<b>S</b>	+	+	<b>S</b>	+	+	+	7
United Kingdom	<b>S</b>	+	+	+	+	+	+	<b>S</b>	<b>S</b>	6
<i>Total</i>	7	11	4	13	9	4	12	5	8	

### Wastewater Chapter Comparisons

Table 8 shows the breakdown in points for the countries and subject areas in the Wastewater chapter. This chapter had a total of 51 instances of the FGS scoring higher than the

OEBGD and there were no negative scores in this chapter. The average score of the Progressives category was 3.89, the Delayers had an average score of 3.67, and the Regressives had an average score of 1.67. Nine of the countries had additional sections or requirements that were not in the OEBGD. Four of the countries in the CENTCOM Area of Responsibility (Qatar, Oman, UAE, and KSA) had additional requirements for discharges to marine environments. Only two countries did not have more stringent requirements for effluent limitations of conventional pollutants and three countries did not have more stringent requirements for limits of non-categorical industrial indirect dischargers.

Table 8. Wastewater chapter comparisons

	<b>Wastewater</b>	<b>Effluent Limitations for Direct Dischargers of Conventional Pollutants</b>	<b>Effluent Limitations for Non-Categorical Industrial Indirect Dischargers</b>	<b>Effluent Limitations for Categorical Industrial Dischargers (Direct or Indirect)</b>	<b>Storm Water Management</b>	<b>Septic System</b>	<b>Sludge Disposal</b>	<i>Total</i>
Belgium	<b>S</b>	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	3
Germany	<b>S</b>	+	+	+	+	+	<b>S</b>	5
Italy	+	+	+	+	+	+	<b>S</b>	6
Japan	<b>S</b>	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	3
Kuwait	<b>S</b>	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	2
Netherlands	+	<b>S</b>	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	2
Oman	+	+	<b>S</b>	<b>S</b>	+	<b>S</b>	<b>S</b>	3
Portugal	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	3
Qatar	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	2
Republic of Korea	+	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	4
Saudi Arabia	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	3
Spain	<b>S</b>	+	+	+	+	<b>S</b>	<b>S</b>	4
Turkey	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
United Arab Emirates	+	+	+	+	+	<b>S</b>	+	6
United Kingdom	+	+	+	+	<b>S</b>	+	<b>S</b>	5
<i>Total</i>	9	13	12	8	5	3	1	

### **Hazardous Materials Chapter Comparisons**

Table 9 shows the breakdown in points for countries and subject areas in the Hazardous Materials chapter. This chapter had a total of 32 instances of a FGS scoring higher than the

OEBGD and had no negative scores. The average score of Progressives was 2.11, the average score of Delayers was 3, and the average score of Regressives was 1.67. Five of the Progressive countries scored 1 or 0 in this chapter which brought the average for that category down. Germany and Spain scored the highest with 5 points while the UAE scored 4 points.

Table 9. Hazardous Materials chapter comparisons

	<b>Hazardous Materials</b>	<b>Storage and Handling</b>	<b>Dispensing Areas</b>	<b>Shipment/Transportation</b>	<b>Master Listing</b>	<b>Labeling (MSDS)</b>	<b>Hazardous Material Management</b>	<b>Total</b>
Belgium	+	<b>S</b>	+	<b>S</b>	+	<b>S</b>	<b>S</b>	3
Germany	+	<b>S</b>	+	<b>S</b>	+	+	+	5
Italy	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	1
Japan	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Kuwait	<b>S</b>	<b>S</b>	<b>S</b>	+	+	<b>S</b>	<b>S</b>	2
Netherlands	+	<b>S</b>	+	<b>S</b>	<b>S</b>	+	<b>S</b>	3
Oman	+	<b>S</b>	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	2
Portugal	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	1
Qatar	+	+	<b>S</b>	+	<b>S</b>	<b>S</b>	<b>S</b>	3
Republic of Korea	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Saudi Arabia	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	+	<b>S</b>	2
Spain	+	+	+	+	<b>S</b>	<b>S</b>	+	5
Turkey	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
United Arab Emirates	+	<b>S</b>	<b>S</b>	+	<b>S</b>	+	+	4
United Kingdom	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	1
<i>Total</i>	11	2	5	4	3	4	3	

## **Hazardous Waste Chapter Comparisons**

Table 10 shows the breakdown in points for countries and subject areas in the Hazardous Waste chapter. This chapter had a total of 60 instances of a FGS scoring higher than the OEBGD. The Progressives scored an average of 4.11, the Delayers 3.67, and the Regressives 2.67. Belgium had 0 points from this chapter because it had two negative scores cancel out the two positive scores. The two subject areas that had the most points were *Record Keeping Requirements* and *Standards for the Management of Used Oil and Lead Acid Batteries* which both had 9 points. The higher scores in record keeping came from the fact that the nine countries required that documents must be kept on file longer than specified in the OEBGD and all five of the countries in the CENTCOM AOR had stricter record keeping requirements. Japan was the only Progressive country that did not have stricter requirements for used oil or batteries while the UAE was the only non-Progressive country to have stricter requirements. *Hazardous Waste Disposal* would have had the most points scored with 10 except negative scores from Belgium, the Netherlands, and Portugal brought the final score to 7.

Table 10. Hazardous Waste chapter comparisons

	<b>Hazardous Waste</b>	<b>Hazardous Waste Generators</b>	<b>Hazardous Waste Accumulation Point</b>	<b>Hazardous Waste Storage Area</b>	<b>Use and Management of Containers</b>	<b>Record Keeping Requirements</b>	<b>Contingency Plan</b>	<b>Tank Systems</b>	<b>Standards for the Management of Used Oil and Lead-Acid Batteries</b>	<b>Hazardous Waste Training</b>	<b>Hazardous Waste Disposal</b>	<i>Total</i>
Belgium	S	S	S	-	S	S	S	+	+	S	-	0
Germany	+	+	S	S	S	S	S	+	+	S	S	4
Italy	+	S	S	+	+	+	S	+	+	S	+	7
Japan	+	S	S	S	S	+	S	S	S	S	+	3
Kuwait	S	+	S	S	S	+	S	S	S	S	+	3
Netherlands	S	S	S	+	+	S	S	+	+	S	-	3
Oman	S	S	S	S	+	+	S	S	S	S	+	3
Portugal	S	+	S	+	S	+	S	S	+	S	-	3
Qatar	S	S	S	S	S	+	S	S	S	S	+	2
Republic of Korea	S	+	S	S	S	S	S	+	+	S	+	4
Saudi Arabia	+	+	S	S	S	+	S	S	S	S	+	4
Spain	+	S	+	+	+	+	S	+	+	S	+	8
Turkey	+	S	S	S	S	S	S	S	S	S	S	1
United Arab Emirates	S	+	S	S	+	+	+	S	+	S	+	6
United Kingdom	S	+	S	+	+	S	S	S	+	S	+	5
<i>Total</i>	6	7	1	4	6	9	1	6	9	0	7	

## **Solid Waste Chapter Comparisons**

Table 11 shows the breakdown in points for countries and subject areas in the Solid Waste chapter. This chapter had a total of 51 instances of a FGS scoring higher than the OEBGD. The average score of the Progressives was 3.89, the average score of the Delayers was 3, and the average score of the Regressives was 1.67. Only two of the Progressives scored lower than a 3, ROK and Italy. The ROK FGS had the same requirements as the OEBGD but had three additional sections and the Italy FGS had two negatives from the lack of landfill criteria that brought its score down to 2. The *Solid Waste Management Plan* area had the highest score with 12 and the ROK was the Progressive that did not have a positive score in that area, while all of the Delayers and Kuwait had more requirements in that area.

Table 11. Solid Waste chapter comparisons

	<b>Solid Waste</b>	<b>Solid Waste Management Plan</b>	<b>New Municipal Solid Waste Landfills</b>	<b>Municipal Solid Waste Landfill Operation</b>	<b>Open Burning</b>	<b>Composting Operations</b>	<b>Composting Usage</b>	<b>Total</b>
Belgium	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	+	3
Germany	+	+	+	+	<b>S</b>	+	+	6
Italy	+	+	-	-	<b>S</b>	+	+	2
Japan	<b>S</b>	+	<b>S</b>	+	<b>S</b>	<b>S</b>	+	3
Kuwait	<b>S</b>	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	3
Netherlands	+	+	<b>S</b>	<b>S</b>	<b>S</b>	+	+	4
Oman	+	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	4
Portugal	+	+	+	+	+	<b>S</b>	<b>S</b>	5
Qatar	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	2
Republic of Korea	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	1
Saudi Arabia	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	+	<b>S</b>	2
Spain	+	+	<b>S</b>	+	<b>S</b>	+	+	5
Turkey	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
United Arab Emirates	<b>S</b>	+	<b>S</b>	+	<b>S</b>	+	<b>S</b>	3
United Kingdom	+	+	+	+	<b>S</b>	+	+	6
<i>Total</i>	<i>11</i>	<i>12</i>	<i>4</i>	<i>7</i>	<i>1</i>	<i>7</i>	<i>7</i>	

### **Petroleum, Oil, and Lubricants Chapter Comparisons**

Table 12 shows the breakdown in points for countries and subject areas in the Petroleum, Oil, and Lubricants (POL) chapter. This chapter had a total of 18 instances where a FGS scored

higher than the OEBGD. The average score of the Progressives was 1.44, the average score of the Delayers was 0.67, and the average score of the Regressives was 0. The POL chapter was the only one that had a country with an overall negative score for the chapter. Spain's lack of information and omitted sections in the POL chapter brought the total score to -1.

Table 12. Petroleum, Oil, and Lubricants chapter comparisons

	<b>Petroleum, Oil, and Lubricants</b>	<b>General POL Storage Container Criteria</b>	<b>Additional POL Storage Container Criteria</b>	<b>Storage Container Wastes</b>	<b>General Transport and Distribution Criteria</b>	<b>Personnel Training</b>	<b>Total</b>
Belgium	+	-	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Germany	+	+	+	<b>S</b>	+	<b>S</b>	4
Italy	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Japan	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Kuwait	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Netherlands	+	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	2
Oman	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Portugal	+	+	<b>S</b>	<b>S</b>	+	<b>S</b>	3
Qatar	+	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	1
Republic of Korea	+	+	+	<b>S</b>	<b>S</b>	<b>S</b>	3
Saudi Arabia	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
Spain	<b>S</b>	+	-	<b>S</b>	<b>S</b>	-	-1
Turkey	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	0
United Arab Emirates	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	+	<b>S</b>	1
United Kingdom	<b>S</b>	+	<b>S</b>	<b>S</b>	+	<b>S</b>	2
<i>Total</i>	6	5	1	0	4	-1	

## Analysis

The results show that the countries in the Progressive category overall score better than countries in the other categories, but the highest scoring country was the UAE and the second lowest scoring country was Japan. Figure 2 shows the scores of the countries in descending order by category. While the Lester Model may not be a great model for determining the stringency of a FGS, it does give an indication of how a country's FGS might perform.

Expanding upon the EPI and WGI, each was tested to see if there was a correlation between the EPI and WGI scores and the FGS scores of the countries. Both had low correlations, as shown in Figure 3 and Figure 4, with EPI having a higher R-squared value of 0.288.

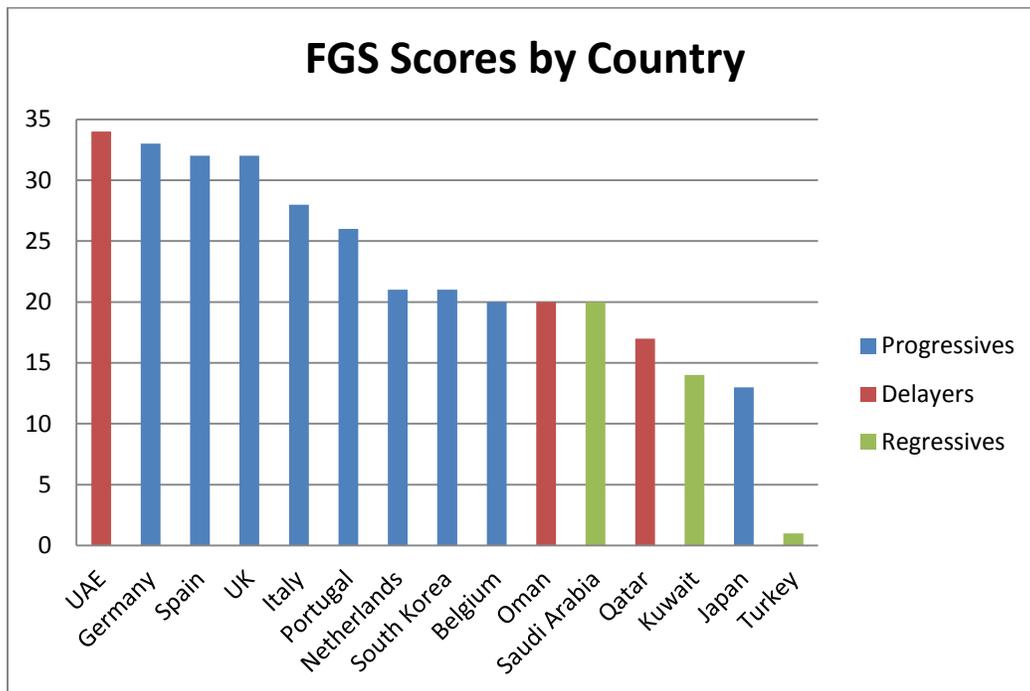


Figure 2. FGS Scores by Country

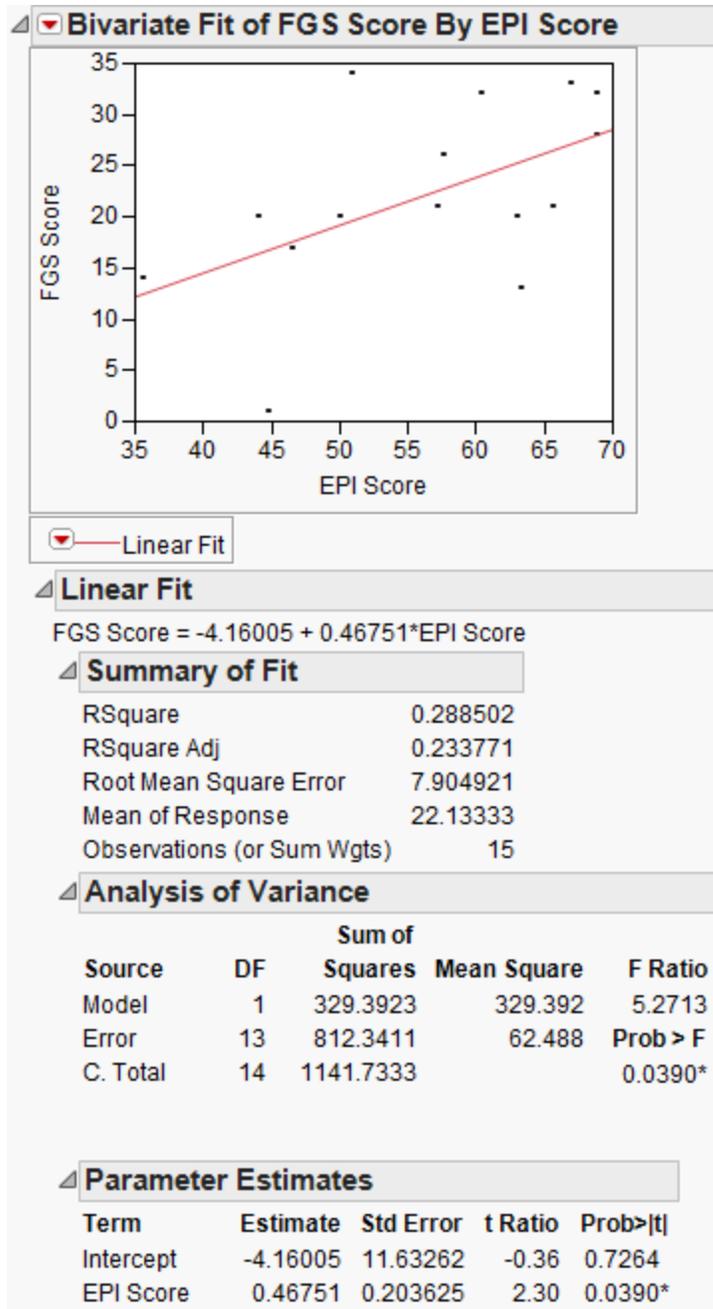


Figure 3. Correlation plot between EPI and FGS Scores

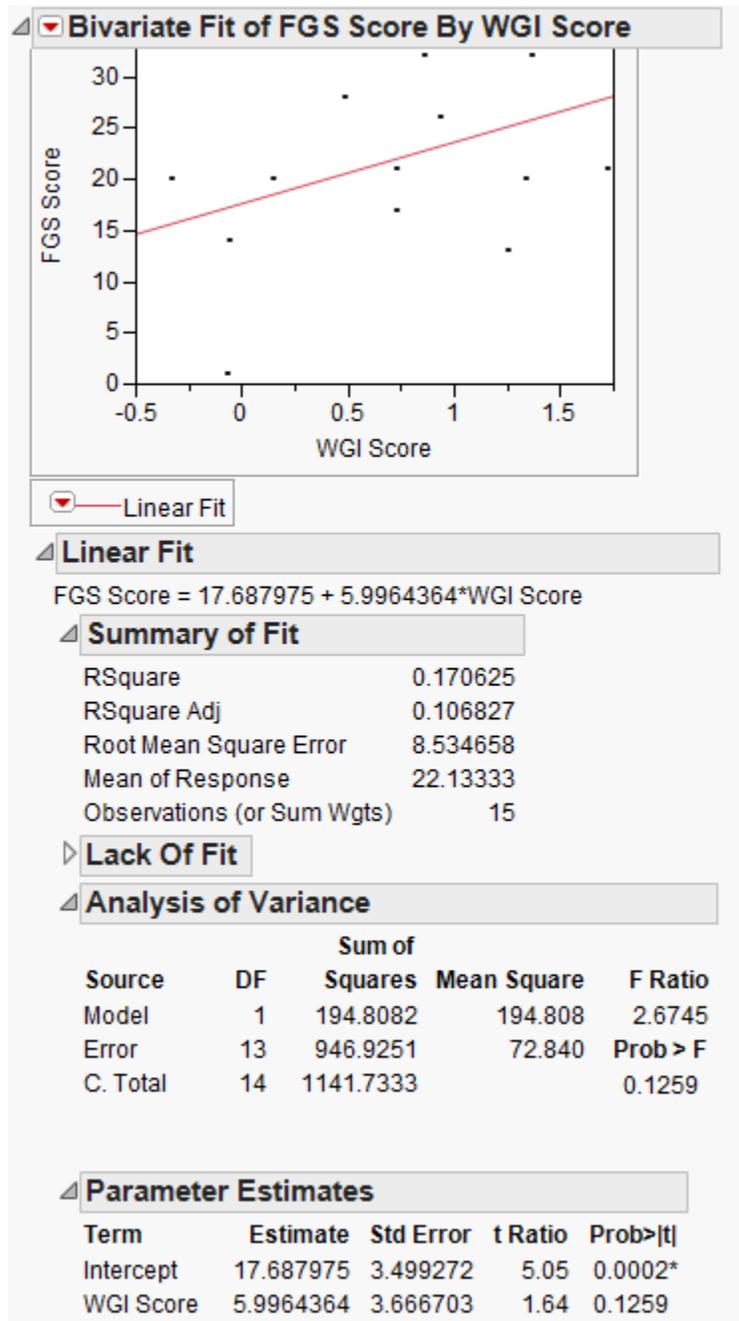


Figure 4. Correlation plot between WGI and FGS Scores

## **Summary**

This chapter contained the results of this analysis and the outcomes of the FGS comparisons. None of the countries in this analysis plotted into the Strugglers category while 9 of the 15 countries were placed in the Progressives category. The analysis of the FGS did not show a strong relationship between FGS scores and Lester Model categories. However, the analysis did highlight a number of errors in the FGS.

## **V. Conclusions and Recommendations**

### **Chapter Overview**

This research investigated if there were relationships between how stringent the different FGS were and a country's position in the Lester Model. This chapter will discuss the overall conclusions and findings of the research. The next section will review the findings and what was discovered during the analysis. Following that, the next section will discuss the significance of the research. The following section will then discuss future research streams from this research.

### **Review of Findings**

The different Final Governing Standards did not perform as was expected in the Lester Model. While the Progressive category did score higher than the other categories on average and the Regressives score was the lowest, there was no strong relationship that showed that FGS comparison scores matched with the Lester Model categories. A country in the Delayers category had the highest FGS score while a country in the Progressives category had the second lowest FGS score. The analysis did identify a number of errors in the different FGS that should have been fixed before publication. The correlation between the EPI and FGS was low, but it did account for almost 1/3 of the variation in the FGS score. This doesn't predict the final FGS stringency, but still could be used as a frame of reference when drafting new FGS.

When this research was first started, the FGS websites were not updated and did not work. The links in the database were broken and even after the links were fixed by the website managers, many of the FGS were dated prior to the OEBGD. In order to get a hold of the most recent FGS for each country, the responsible commands were contacted and the environmental managers supplied the necessary documents. Since the completion of this thesis effort, the

DENIX website has now been completely updated and the most current FGS are all available on the website.

### **Significance of Research**

While the research didn't provide the predictive model as anticipated, the comparisons did highlight a number of errors in the FGS. There were a total of fifteen errors found across six FGS which is a fairly small amount for the sheer volume of writing. Of the errors, only 4 of them are significant because they deal with MCLs or minimum requirements. The other 11 errors are spelling or formatting mistakes that of no real consequence. The significant errors are contradictory statements (2 – Kuwait, 1 – Netherlands, and 1 – Oman) where the text has more than one requirement or conflicting requirements. This could cause confusion or a non-compliance situation if someone uses the incorrect requirement without knowing that there was a more stringent requirement elsewhere in the chapter. The other mistakes are either spelling or formatting mistakes and in the cases where the FGS has incorrect information, it is obvious enough that there is a mistake. In these cases, anyone looking for that information in the FGS should contact the responsible EEA for clarification.

While the model developed in this research doesn't have a strong predictive capability, it can still be useful to the drafters of future FGS to understand where a country falls in the Lester Model or to know what the country's EPI and WGI scores are. Not all countries (especially smaller ones) have an EPI score, so using the EPI score as a starting reference point for the stringency of a FGS is limited. Table 13 shows countries in the Asia-Pacific region that the U.S. does not have current FGS with and have both EPI and WGI scores. Unlike the countries that the U.S. currently has FGS with, there are no Delayers in the Asia-Pacific region but a number of countries in the Strugglers category. Using the EPI as a preliminary measure of FGS stringency

could be useful to drafters as a reference point should the need arise to create a new FGS with any of these countries.

Table 13. Table of Asia-Pacific Countries without existing FGS

<b>Country</b>	<b>Lester Model Category</b>	<b>EPI Score</b>	<b>Average WGI Score</b>
Australia	Progressives	56.61	1.61
Bangladesh	Regressives	42.55	-0.89
Brunei Darussalam	Progressives	62.49	0.65
Cambodia	Strugglers	55.29	-0.72
China	Regressives	42.24	-0.51
India	Regressives	36.23	-0.37
Indonesia	Strugglers	52.29	-0.40
Malaysia	Progressives	62.51	0.34
Mongolia	Regressives	45.37	-0.21
Myanmar	Strugglers	52.72	-1.09
Nepal	Strugglers	57.97	-0.92
New Zealand	Progressives	66.05	1.81
Pakistan	Regressives	39.56	-1.17
Philippines	Strugglers	57.40	-0.39
Singapore	Progressives	56.36	1.58
Sri Lanka	Strugglers	55.72	-0.34
Taiwan	Progressives	62.23	0.97
Thailand	Strugglers	59.98	-0.27
Viet Nam	Regressives	50.64	-0.53

## **Recommendations for Future Research**

Future research could follow the methodology of Lt Col Smith and interview the environmental offices at each installation that falls under a FGS. The experience of the personnel responsible for environmental compliance in each of these countries may validate the position of these countries in the Lester Model. Interviews could capture important factors that influence the drafting of FGS that are not captured in the document itself. Expanding on that possibility, another research opportunity would be to conduct interviews with people who are heavily involved in the drafting and upkeep of FGS to determine what factors influence FGS stringency the most.

A third potential research project would be research if the constant upkeep of FGS is an activity that is worth keeping. While the OEBGD is supposed to be the baseline environmental standards for U.S. forces, there are contingency environments that operate under separate environmental agreements that may not be as stringent as the OEBGD. Some of these contingencies environments have been active for the better part of a decade and yet do not require a FGS because of the agreement between the U.S. and the Host Nation.

## **Summary**

This research compared the requirements and criteria of the different active FGS that the U.S. government has with foreign nations. The purpose was to determine if there were any relationships between the FGS scores and the location of the country in a model of environmental performance and government capability. While the model used in this research did not show a strong relationship with the FGS scores, the comparisons did highlight a number of issues with the FGS. Specifically, a number of errors spread throughout multiple FGS that need to be addressed.

## Appendix A – OEBGD and FGS Comparisons

### Italy – 2012

<i>Air Emissions</i>	S
Boilers <sup>1</sup>	+
Incinerators <sup>2</sup>	+
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances <sup>3</sup>	+
Motor Vehicles <sup>4</sup>	+
Stack Heights	S

<i>Drinking Water<sup>5</sup></i>	
System <sup>6</sup>	+
Coliform <sup>7</sup>	+
Inorganic <sup>8</sup>	+
Fluoride <sup>9</sup>	+
Lead and Copper	S
Synthetic Organics <sup>10</sup>	+
Disinfectant Byproduct Monitoring <sup>11</sup>	+
Radionuclide <sup>12</sup>	+

<sup>1</sup> Additional requirement for thermal civil systems and resulting emulsions. There are requirements for the composition of liquid fuels and biodiesel used in combustion.

<sup>2</sup> Permits required to operator incinerators. Restrictions on daily average and 30-minute average emissions of PM, organic compounds, chlorine inorganic, fluorine inorganic, SO<sub>2</sub>, and NO<sub>2</sub>. FGS does not address sludge waste incinerators but specifies non-medical incinerator burner designs.

<sup>3</sup> FGS sets additional restrictions and prohibitions on the use of ODS in non-critical uses (table lists critical uses). FGS has much stricter requirements on leak monitoring and detection. FGS has a table listed approved technologies for the destruction of ODS.

<sup>4</sup> FGS has additional criteria for vehicle emission standards.

<sup>5</sup> Produced water systems must be permitted.

<sup>6</sup> Potable water distribution system maps shall be updated at least annually. Permits are required for withdrawal and distribution of DoD drinking water. FGS adds zoning criteria around wellheads and piping that limit activities around water supplies. Underground injection is prohibited with a few exceptions and requires a permit. Turbidity of water cannot exceed 1 NTU. FGS does not have non-public water systems.

<sup>7</sup> FGS has additional microbiological MCLs.

<sup>8</sup> Stricter MCLs for listed chemicals and adds additional chemical MCLs. Different requirements for DoD-produced and purchased water. FGS mandates testing methods follow specified performance characteristics.

<sup>9</sup> Fluoride has stricter MCL of 1.5 mg/L. Lower upper control limit at low temperatures.

<sup>10</sup> MCLs for DoD-purchased water match OEBGD, but MCLs for DoD-produced water are stricter than OEBGD.

<sup>11</sup> Stricter MCLs for total TTHM and chlorite in drinking water.

<b>Wastewater</b> <sup>13</sup>	+
Effluent Limitation direct conventional <sup>14</sup>	+
Effluent Limitation non-categorical indirect <sup>15</sup>	+
Effluent Limitation categorical dischargers <sup>16</sup>	+
Storm water <sup>17</sup>	+
Septic <sup>18</sup>	+
Sludge	S

<b>Hazardous Materials</b> <sup>19</sup>	+
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Material Labeling and MSDS	S
Hazardous Material Management	S

<b>Hazardous Waste</b> <sup>20</sup>	+
HW Generators	S
Accumulation Points	S
Storage Areas <sup>21</sup>	+
Containers <sup>22</sup>	+
Record Keeping <sup>23</sup>	+
Contingency Plan	S
Tank Systems <sup>24</sup>	+
Used Oil and Lead Acid Batteries <sup>25</sup>	+

<sup>12</sup> Additional requirements for tritium and total indicative dose.

<sup>13</sup> Additional sections of reclaimed wastewater and complaint system.

<sup>14</sup> Further restrictions on regional discharges and discharges to sewers, soils, or shallow subsoils.

<sup>15</sup> Higher pH of wastewater is required. Additional section on pumped wastewater and using a grinder on organic food wastes.

<sup>16</sup> FGS has discharge standards for pollutants, regardless of the discharge amounts. Further requirements on monitoring for pollutants.

<sup>17</sup> Regional requirements for storm water discharges.

<sup>18</sup> All septic systems have to be permitted.

<sup>19</sup> An additional section on the use of particular substances.

<sup>20</sup> Additional criteria for special and hazardous special waste.

<sup>21</sup> Within some exceptions, HWSA (or Temporary WSA) require permits for operation. Additional requirements for TWSA.

<sup>22</sup> Stricter requirement for secondary containment.

<sup>23</sup> Records must be kept for at least 5 years.

<sup>24</sup> Additional requirement for AST to have a containment system that meets specified volumes.

Training	S
Disposal <sup>26</sup>	+

<i>Solid Waste</i> <sup>27</sup>	+
Solid Waste Management Plan <sup>28</sup>	+
New Municipal Solid Waste Landfills <sup>29</sup>	-
Municipal Solid Waste Landfill Operation <sup>29</sup>	-
Open Burning	S
Composting Operations <sup>30</sup>	+
Compost Usage <sup>31</sup>	+

<i>Petroleum, Oil, and Lubricants</i>	S
General POL Storage criteria	S
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

---

<sup>25</sup> Used oil burning requires a permit. FGS has further requirements for boilers that burn used oil. Further requirements for mercury, nickel-cadmium, and lithium batteries.

<sup>26</sup> Additional requirements for the disposal of vehicle parts and scrap.

<sup>27</sup> FGS has sections dedicated to “special waste” which is non-organic waste and includes both non-hazardous and hazardous waste.

<sup>28</sup> FGS says that installations shall consult with Italian counterparts on issues pertaining to management of urban (solid) waste. SWMP has additional specific requirements not in OEBGD.

<sup>29</sup> FGS makes mention that landfills must be permitted by HN but does not go into specifics as the OEBGD does.

<sup>30</sup> Composting is allowed with the exception of green mulch.

<sup>31</sup> More stringent requirements for the use and composition of compost.

**Turkey – 2008**

<i>Air Emissions</i>	S
Boilers	S
Incinerators	S
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances	S
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i>	S
System	S
Coliform	S
Inorganic	S
Fluoride	S
Lead and Copper	S
Synthetic Organics	S
Disinfectant Byproduct Monitoring	S
Radionuclide	S

<i>Wastewater</i>	S
Effluent Limitation conv	S
Effluent Limitation non-cate indirect <sup>1</sup>	S
Effluent Limitation cate dischargers	S
Storm Water	S
Septic	S
Sludge	S

<i>Hazardous Materials</i>	S
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Material Safety Data Sheets	S
HAZMAT management	S
<i>Hazardous Waste<sup>2</sup></i>	+

---

<sup>1</sup> Same error as OEBGD.

HW Generators	S
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping	S
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries	S
Training	S
Disposal	S

<i>Solid Waste</i>	S
Solid Waste Management Plan	S
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation	S
Open Burning	S
Composting Operations	S
Compost Usage	S

<i>Petroleum, Oil, and Lubricants</i>	S
General POL Storage criteria	S
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

---

<sup>2</sup> Installations shall develop and use hazwaste minimization plans to reduce the amount of hazardous waste generated.

## Qatar – 2011

<i>Air Emissions</i> <sup>1</sup>	+
Steam/Hot Water Generating Units	S
Incinerators	S
PCE Dry Cleaning	S
Chromium Electroplating and Chromium Anodizing Tanks	S
Halogenated Solvent Cleaning Machines	S
Units containing O-zone Depleting Substances	S
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i>	S
System <sup>2</sup>	+
Total Coliform	S
Inorganic <sup>3</sup>	+
Fluoride <sup>4</sup>	+
Lead and Copper	S
Synthetic Organics <sup>5</sup>	+
Disinfectant Byproduct Monitoring <sup>6</sup>	+
Radionuclide <sup>7</sup>	+

<i>Wastewater</i> <sup>8</sup>	+
Effluent Limitation (conventional pollutants) <sup>9</sup>	+
Effluent Limitation (non-categorical indirect dischargers)	S
Effluent Limitation (categorical dischargers)	S
Storm water	S

<sup>1</sup> Additional sections on ambient air quality, hazardous healthcare waste treatment, and the manufacture and use of harmful ODS.

<sup>2</sup> Additional section on water quality.

<sup>3</sup> FGS has stricter MCLs and has additional chemical MCLs.

<sup>4</sup> Fluoride upper control limit at low temperatures.

<sup>5</sup> Stricter MCL's for some SOC and VOC, and also adds additional chemicals not in OEBGD.

<sup>6</sup> FGS has lower MCL of TTHM and chlorite. FGS also has lower maximum residual disinfectant levels for chlorine and chloramines (when ammonia is added during chlorination).

<sup>7</sup> FGS has additional requirement for radon not to exceed 100 be/L. Gross Alpha MCL lower than OEBGD. Additional MCLs for other radionuclides.

<sup>8</sup> It is expressly prohibited to dump untreated wastewater into the coastal environment. Wastewater systems must be equipped with flow measuring devices and collection equipment. There are also additional limits on the discharges of some substances into marine environments, public sewers, ballast water, and wastewater treatment

<sup>9</sup> Existing sources of pollutants have lower 7-day average limits for BOD<sub>5</sub> and TSS.

Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>10</sup>	+
Storage and Handling <sup>11</sup>	+
Dispensing Areas	S
Shipment/Transportation <sup>12</sup>	+
Master Listing	S
Material Labeling and MSDS	S
Hazardous Material Management	S

<b><i>Hazardous Waste</i></b>	S
HW Generators	S
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping <sup>13</sup>	+
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries	S
Training	S
Disposal <sup>14</sup>	+

<b><i>Solid Waste</i></b> <sup>15</sup>	+
Solid Waste Management Plan <sup>16</sup>	+
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation	S
Open Burning	S
Composting Operations	S
Compost Usage	S

<sup>10</sup> Additional sections and requirements.

<sup>11</sup> FGS has minimum separation distances from the public and other hazardous chemicals according to their hazard classification.

<sup>12</sup> Additional requirements for tankers when transporting hazardous materials by land.

<sup>13</sup> Manifests and copies of all transportation documents must be kept for five years. Waste Analysis/Characterization Records must be kept at least 5 years after the closure of a HWSA.

<sup>14</sup> Landfills must be approved by CENTCOM/CCJ4E and must be designed to prevent leakage of wastes to soil layers, ground water, or surface water, and that no dispersal due to winds would take place.

<sup>15</sup> Additional section on wastewater sludge.

<sup>16</sup> FGS expressly prohibits dumping wastes in particular areas of concern. Also no dumping of liquids that can cause pollution in HN waters, trash in transport must be covered.

<i>Petroleum, Oil, and Lubricants</i> <sup>17</sup>	+
General POL Storage Container Criteria	S
Additional POL Storage Container Criteria	S
Storage Container Wastes	S
General Transport and Distribution Criteria	S
Personnel Training	S

---

<sup>17</sup> Additional criteria for ships at sea within 200 NM of Qatar.

**Germany – 2010**

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators	S
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning <sup>3</sup>	+
O-zone Depleting Substances <sup>4</sup>	+
Motor Vehicles <sup>5</sup>	+
Stack Heights <sup>6</sup>	+

<i>Drinking Water</i> <sup>7</sup>	+
System <sup>8</sup>	+
Coliform	S
Inorganic	S
Fluoride	S
Lead and Copper	S
Synthetic Organics <sup>9</sup>	+
Disinfectant Byproduct Monitoring	S
Radionuclide	S

<i>Wastewater</i>	S
Effluent Limitation conv pollutants <sup>10</sup>	+

<sup>1</sup> Additional sections on permits and notification, woodworking facilities, gasoline storage, tank farms, filling stations, and emissions declarations.

<sup>2</sup> FGS is very specific on boiler types and sizes. It also requires inspections by local authorities to ensure they are meeting local emission standards.

<sup>3</sup> FGS has additional requirements for notifying German regulatory agencies when using organic solvents. FGS has more requirements for any facility using halogenated solvent cleaning machines and non-halogenated solvents as well as additional record keeping requirements for these facilities.

<sup>4</sup> FGS requires that all equipment containing more than 6.6 lbs of refrigerant be inspected annually for leaks and records kept for 5 years. FGS has an additional section on Fluorinated Greenhouse Gases with further requirements on inspections and record keeping. FGS has 2 sections on Class I and II ODS use prohibitions.

<sup>5</sup> FGS has stricter requirements on gasoline lead concentrations and additives in gasoline. Also sulfur compound restrictions in diesel fuel.

<sup>6</sup> FGS has additional requirements for boilers and flat roofs.

<sup>7</sup> Permits required before using any water body.

<sup>8</sup> FGS requires prohibits the injection of certain substances into groundwater without a permit.

<sup>9</sup> Additional compounds MCLs not listed in OEBGD.

<sup>10</sup> FGS has more detailed requirements for treatment facilities and separates them into 5 categories based on the capacity of the facility. FGS also has nitrogen and phosphorus limits for discharges into environmentally sensitive areas.

Effluent Limitation non-cate indirect <sup>11</sup>	+
Effluent Limitation categorical <sup>12</sup>	+
Storm Water <sup>13</sup>	+
Septic <sup>14</sup>	+
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>15</sup>	+
Storage and Handling	S
Dispensing Areas <sup>16</sup>	+
Shipment	S
Master Listing <sup>17</sup>	+
Material Safety Data Sheets <sup>18</sup>	+
Hazmat management <sup>19</sup>	+

<b><i>Hazardous Waste</i></b> <sup>20</sup>	+
HW Generators <sup>21</sup>	+
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping	S
Contingency Plan	S
Tank Systems <sup>22</sup>	+
Used Oil and Lead Acid Batteries <sup>23</sup>	+

<sup>11</sup> FGS has a list of instances where any discharge, even indirect discharge, is prohibited. The OEBGD has no such restrictions. The FGS discharge standards are in concentration before mixing with waste water but OEBGD is in daily maximum and 4-day average.

<sup>12</sup> Stricter discharge standards for electroplating, uses 2-hour mixed sample or random sample. Also adds new pollutants to test for.

<sup>13</sup> FGS has region specific requirements for storm water systems, sewers, and storm water control facilities.

<sup>14</sup> FGS has an additional requirement that any facilities located in Bayern must be inspected by technical experts.

<sup>15</sup> German's FGS has significantly more requirements on hazardous materials and has the additional sections: annual training; banned or restricted hazardous materials; facilities that store, distribute, and handle hazardous substances; packing labels; ASTs; piping; compressed gas cylinders; chlorine facilities.

<sup>16</sup> FGS has additional requirements for aisle width of storage areas and aisle markings.

<sup>17</sup> FGS has additional requirements that inventory must be updated annually or after any significant change to type and quantity of hazardous materials stored and/or used.

<sup>18</sup> Additional criteria for areas that store and/or handle hazardous materials.

<sup>19</sup> Specific training topics and record keeping requirements.

<sup>20</sup> FGS has additional sections: Tendering of hazardous waste, permitted transportation and disposal companies, waste management officer, provision of statistical information, and daily removal of HW to a HWAP or HWSA.

<sup>21</sup> FGS is more specific on different procedures and types of generators and their manifesting requirements.

<sup>22</sup> FGS has specific requirements for closures of tanks. In Germany, there is no distinction between tanks that store hazardous waste and those that store hazardous materials so the requirements for storing hazardous materials also apply to hazardous waste.

Training	S
Disposal	S

<b><i>Solid Waste</i></b> <sup>24</sup>	+
Solid Waste Management Plan <sup>25</sup>	+
New Municipal Solid Waste Landfills <sup>26</sup>	+
Municipal Solid Waste Landfill Operation <sup>27</sup>	+
Open Burning	S
Composting Operations <sup>28</sup>	+
Compost Usage <sup>29</sup>	+

<b><i>Petroleum, Oil, and Lubricants</i></b> <sup>30</sup>	+
General POL Storage Container Criteria <sup>31</sup>	+
Additional POL Storage Container Criteria <sup>32</sup>	+
Storage Container Wastes	S
General Transport and Distribution Criteria <sup>33</sup>	+
Personnel Training	S

---

<sup>23</sup> FGS has more requirements for the uses of used oil.

<sup>24</sup> The SW chapter has additional sections: Recordkeeping; Shipment of Waste; Waste Management Criteria; Reporting Criteria; Disposal of Waste Meat, Animal Carcasses, and Animal Parts; and Solid Waste Incinerators.

<sup>25</sup> The FGS requirements for a SWMP is very specific and must detail how the installation plans to deal with waste in the order of preference of waste avoidance, waste minimization, waste recovery, incineration, and disposal in a landfill. It also has the additional criteria sections of store and disposal of scrap vehicles, biodegradable waste, electrical and electronic equipment, and commercial solid waste.

<sup>26</sup> New or Expanded landfills must be approved through German authorities and a planning assessment is required before approval.

<sup>27</sup> Additional recurring training is required for all personnel associated with operating landfills. Any gas emitted from the MSWLF has to be collected and recovered and potential migration of landfill gas towards structures needs to be measured.

<sup>28</sup> FGS requires keeping records of temperature curves, turning times (aerobic), and loading intervals for 5 years.

<sup>29</sup> FGS sets limits on the amount of compost used and has lower contaminate concentration levels than OEBGD. FGS puts restrictions on compost use in certain areas of the country and forested areas.

<sup>30</sup> FGS has additional sections on regional filling stations in Hessen.

<sup>31</sup> Secondary containment must be at least 10% of total content of all tanks or entire contents of largest single tank. Drainage areas are not allowed to have drain outlets unless permitted by HN authorities.

<sup>32</sup> FGS requires containment at loading/unloading areas, eliminates the clause if it is reasonable expected to cause a sheen on waters of the HN – this eliminates implied statement about only necessary if there is a chance of sheen entering waters.

<sup>33</sup> FGS has additional requirements for offsite pipelines and POL storage facilities part of the distribution network.

## Japan – 2012

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators <sup>3</sup>	+
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances	S
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i>	S
System	S
Coliform	S
Inorganic <sup>4</sup>	+
Fluoride	S
Lead and Copper	S
Synthetic Organics	S
Disinfectant Byproduct Monitoring	S
Radionuclide	S

<i>Wastewater</i>	S
Effluent Limitation conv <sup>5</sup>	+
Effluent Limitation non-cate indirect <sup>6</sup>	+
Effluent Limitation categorical <sup>7</sup>	+
Storm Water	S
Septic	S
Sludge	S

---

<sup>1</sup> FGS has additional sections: Diesel/Gaseous/Gasoline Engine Generating and Gas Turbine Units, Emission Limits for Sulfur Oxides, and VOCs.

<sup>2</sup> FGS has additional requirements smaller boiler units and regional restrictions.

<sup>3</sup> FGS requires additional emission monitoring for waste, hazardous air pollutants, and dioxin.

<sup>4</sup> More stringent MCLs.

<sup>5</sup> FGS has a lower pH requirement for discharges to lakes and rivers. Further restrictions on pollutants in wastewater discharged to the HN waters

<sup>6</sup> FGS has a stricter closed cup flashpoint temperature requirement.

<sup>7</sup> Further requirements on pollutant levels in discharges. Specified requirements for regional discharges and additional table of hazardous substance effluent discharges.

<b><i>Hazardous Materials</i></b>	<b>S</b>
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Labeling	S
HAZMAT management	S

<b><i>Hazardous Waste</i></b> <sup>8</sup>	<b>+</b>
HW Generators	S
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping <sup>9</sup>	+
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries	S
Training	S
Disposal <sup>10</sup>	+

<b><i>Solid Waste</i></b>	<b>S</b>
Solid Waste Management Plan <sup>11</sup>	S
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation <sup>12</sup>	+
Open Burning	S
Composting Operations	S
Compost Usage <sup>13</sup>	+

<b><i>Petroleum, Oil, and Lubricants</i></b>	<b>S</b>
General POL Storage criteria	S

<sup>8</sup> Additional section on contaminated soil disposal criteria.

<sup>9</sup> Turn-in documents, manifests, inspection logs, and waste analysis reports must be maintained for 5 years as opposed to 3 years.

<sup>10</sup> Restrictions on contracting out the disposal of hazwaste and no HW originating away from the Japanese islands is allowed for disposal in Japan. Hazardous waste shall not be land disposed on any DoD installation in Japan. Disposing of contaminated soil has separate requirements from other hazardous waste.

<sup>11</sup> Additional requirements for contracting of industrial waste transportation or disposal.

<sup>12</sup> Landfill bottom liner permeability requirement is stricter (0.00001 cm/sec) than OEBGD (0.00005 cm/sec).

<sup>13</sup> FGS has additional contaminants in the compost use requirements. The Japan FGS labels the limits in compost as Maximum Total Compost Concentration Standard (mg/kg of soil) but the OEBGD gives the limits in average contaminant concentrations in mg/kg (dry weight).

Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

## South Korea – 2012

<i>Air Emissions</i> <sup>1</sup>	+
Boilers	S
Incinerators <sup>2</sup>	+
PCE Dry Cleaning <sup>3</sup>	+
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances <sup>4</sup>	+
Motor Vehicles <sup>5</sup>	+
Stack Heights	S

<i>Drinking Water</i>	S
System <sup>6</sup>	+
Coliform <sup>7</sup>	-
Inorganic <sup>8</sup>	+
Fluoride	+
Lead and Copper <sup>9</sup>	+
Synthetic Organics	S
Disinfectant Byproduct Monitoring	S
Radionuclide <sup>10</sup>	+

<i>Wastewater</i> <sup>11</sup>	+
Effluent Limitation conv <sup>12</sup>	+
Effluent Limitation non-cate indirect <sup>13</sup>	+
Effluent Limitation cate dischargers <sup>14</sup>	+
Storm Water	S

<sup>1</sup> FGS has additional sections for gas stations and activities that emit air pollutants.

<sup>2</sup> FGS has additional requirements for smaller incinerators as well as standards for offensive odors.

<sup>3</sup> Also has requires compliance for machines with a rated capacity  $\geq 30$  kg.

<sup>4</sup> FGS has more chemicals considered ODS.

<sup>5</sup> FGS has additional requirements for inspection of vehicles and emission requirements.

<sup>6</sup> Requirements specify how groundwater wells will be installed and constructed. Personnel operating DoD water treatment facilities must be recertified every 3 years. Filtration required if water exceeds 1 NTU.

<sup>7</sup> FGS stops listing coliform monitoring frequency populations greater than 50,000.

<sup>8</sup> FGS has additional inorganic chemicals listed and has secondary MCLs.

<sup>9</sup> FGS requires more monitoring for lead and copper but does not address populations greater than 100,000.

<sup>10</sup> Additional MCLs for strontium-90 and tritium.

<sup>11</sup> Additional sections on laboratory analysis and domestic garbage disposal units.

<sup>12</sup> FGS does not specify what the effluent limitations are (30-day averages or single measurement) but there are multiple requirements depending on locations and dates. Also limitations on phosphorous and coliform bacteria.

<sup>13</sup> Discharges of wastewater cannot have pH above 9.0.

<sup>14</sup> Additional industrial wastewater sources identified and more effluent requirements for pollutants.

Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b>	<b>S</b>
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Material Safety Data Sheets	S
HAZMAT management	S

<b><i>Hazardous Waste</i></b>	<b>S</b>
HW Generators <sup>15</sup>	+
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping	S
Contingency Plan	S
Tank Systems <sup>16</sup>	+
Used Oil and Lead Acid Batteries <sup>17</sup>	+
Training	S
Disposal <sup>18</sup>	+

<b><i>Solid Waste</i></b> <sup>19</sup>	<b>+</b>
Solid Waste Management Plan	S
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation	S
Open Burning	S
Composting Operations	S
Compost Usage	S

---

<sup>15</sup> FGS has additional statement that dry materials must be covered during transport and liquids must be contained to prevent leakage or discharge.

<sup>16</sup> Existing tank systems that don't have secondary containment must be approved by the Executive Environmental Agent.

<sup>17</sup> Used oil burned for energy recovery cannot exceed 4,000 ppm total halogens

<sup>18</sup> Additional section on wastes that are destined for disposal at ROK disposal facilities must be identified according to criteria laid out in the FGS. ROK facilities also need to show standards for waste synthetic polymer and waste paint and lacquer.

<sup>19</sup> Additional sections on construction waste, prohibition of open dumping, and food waste management.

<i>Petroleum, Oil, and Lubricants</i> <sup>20</sup>	+
General POL Storage criteria <sup>21</sup>	+
Additional POL storage criteria <sup>22</sup>	+
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

---

<sup>20</sup> Additional sections and requirements for a Storage Container Management Plan and non-temporary vehicle fueling stations.

<sup>21</sup> FGS mandates the use of a leak barrier with leak detection for below ground storage.

<sup>22</sup> Additional criteria for acceptable leak detection methods.

## Saudi Arabia – 2010

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators	S
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances	S
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i> <sup>3</sup>	+
System <sup>4</sup>	+
Coliform	S
Inorganic <sup>5</sup>	+
Fluoride <sup>6</sup>	+
Lead and Copper	S
Synthetic Organics <sup>7</sup>	+
Disinfectant Byproduct Monitoring <sup>8</sup>	+
Radionuclide <sup>9</sup>	+

<i>Wastewater</i> <sup>10</sup>	+
Effluent Limitation direct discharge conv <sup>11</sup>	+
Effluent Limitation non-categorical indirect <sup>12</sup>	+
Effluent Limits categorical discharges	S
Storm water	S

<sup>1</sup> FGS sets ambient air quality standards for any operations that emit SO<sub>2</sub>, particulates, ODS, NO<sub>2</sub>, CO, H<sub>2</sub>S, or fluorides. Additional requirement for emissions from healthcare waste facilities

<sup>2</sup> FGS has more stringent requirements for NO<sub>x</sub> and PM.

<sup>3</sup> Additional sections on bottled drinking water.

<sup>4</sup> Additional section on water quality.

<sup>5</sup> More stringent MCL for listed chemicals and adds MCLs for additional chemicals.

<sup>6</sup> Stricter upper control limit for fluoride at low temperatures.

<sup>7</sup> Adds additional chemical MCLs and has stricter MCLs for some of the listed organic chemicals and pesticides.

<sup>8</sup> Maximum residual disinfectant level of 3.0 mg/L for combined total chlorine and (new requirement) of 0.5 mg/L for chlorine for at least 30 minutes with a pH level < 5.

<sup>9</sup> Stricter MCL for gross alpha.

<sup>10</sup> Additional requirements section with further guidance on waste water treatment, dischargers, and ballast water discharges.

<sup>11</sup> Stricter BOD<sub>5</sub> and TSS limits. Tables with discharge requirements.

<sup>12</sup> No wastewater with pH above 10.0 is allowed to be discharged unless the DWTS is specifically designed to handle it. Maximum limit of discharge of oil and grease is 120 mg/L. Tables with discharge requirements.

Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>13</sup>	+
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Material Safety Data Sheets (Labeling) <sup>14</sup>	+
HAZMAT Management	S

<b><i>Hazardous Waste</i></b> <sup>15</sup>	+
HW Generators <sup>16</sup>	+
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping <sup>17</sup>	+
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries	S
Training	S
Disposal <sup>18</sup>	+

<b><i>Solid Waste</i></b> <sup>19</sup>	+
Solid Waste Management Plan	S
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation	S
Open Burning	S

---

<sup>13</sup> Additional sections for packaging, transportation by land, storage and handling. **ERROR IN PARAGRAPH NUMBERING.**

<sup>14</sup> Additional requirements for labeling of hazardous materials

<sup>15</sup> Additional requirements for working with hazardous waste.

<sup>16</sup> Generators of HW must provide transporters and receiving locations of HW with all the information on the waste and samples for analysis, with some exceptions. Transporters may fall under the generators requirement if they mix HW.

<sup>17</sup> All HW-related paperwork must be kept for at least 5 years.

<sup>18</sup> No HAZWASTE will be discharged or disposed of in the KSA territorial waters. Landfills must be designed and operated to prevent leakage to soil layers, ground water, surface water, or wind dispersal. **ERROR IN PARAGRAPH C6.3.10.8.1.3. Biodegradation – spelling error, says 11W instead of HW**

<sup>19</sup> FGS has restrictions on using sludge in agriculture and forestry. FGS gives instructions on the collecting and drying of sludge as well as pollutant limits MCLs of heavy metals and organic compounds.

Composting Operations <sup>20</sup>	+
Compost Usage	S

<i>Petroleum, Oil, and Lubricants</i>	S
General POL	S
Additional POL	S
Storage container wastes	S
Transport and distribution criteria	S
Personnel training	S

---

<sup>20</sup> FGS requires additional testing for composting operations.

## Kuwait – 2011

<i>Air Emissions</i> <sup>1</sup>	+
Boilers	S
Incinerators	S
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances	S
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i>	S
System	S
Coliform	S
Inorganic <sup>2</sup>	+
Fluoride	S
Lead and Copper <sup>3</sup>	+
Synthetic Organics <sup>4</sup>	+
Disinfectant Byproduct Monitoring	S
Radionuclide	S

<i>Wastewater</i>	S
Effluent Limitation conventional pollutants <sup>5</sup>	+
Effluent Limitation non-categorical indirect <sup>6</sup>	+
Effluent Limitation categorical dischargers	S
Storm water	S
Septic	S
Sludge	S

<sup>1</sup> FGS has additional sections on Cement Production, storage tanks emissions, and industrial emission limits.

<sup>2</sup> Stricter MCLs for listed chemicals and adds additional MCLs. *The Fluoride section states that the MCL is 4 mg/L but the inorganic MCL table puts the MCL at 2 mg/L, this is another mistake of the FGS.*

<sup>3</sup> Stricter action level for lead.

<sup>4</sup> FGS has stricter MCLs for a couple organic compounds and adds more not listed in OEBGD. *The table has two mistakes: firstly, the table name is incorrect (It inadvertently repeats the heading for table 5 and secondly, the MCL for Di(2-ethylhexyl) adipate is missing numbers after the decimal place.*

<sup>5</sup> Additional criteria for direct discharges to maritime waters.

<sup>6</sup> Additional MCLs for chemicals in indirect discharges.

<i>Hazardous Materials</i>	S
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Labeling	S
HAZMAT Management	S

<i>Hazardous Waste</i>	S
HW Generators <sup>7</sup>	+
Accumulation Points	S
Storage Areas	S
Containers	S
Record Keeping <sup>8</sup>	+
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries	S
Training	S
Disposal <sup>9</sup>	+

<i>Solid Waste</i>	S
Solid Waste Management Plan <sup>10</sup>	+
New Municipal Solid Waste Landfills <sup>11</sup>	+
Municipal Solid Waste Landfill Operation <sup>12</sup>	+
Open Burning	S
Composting Operations	S
Compost Usage	S

---

<sup>7</sup> HW Generators are required to have written management plans and procedures.

<sup>8</sup> HW Shippers must keep manifests for at least 5 years – **conflicts with other Record Keeping requirements.**

<sup>9</sup> Land disposal facilities cannot be located any less than 2 kilometers away from the nearest water supply well.

<sup>10</sup> Additional criteria for the disposal of batteries in accordance with army policy. Specific requirements for disposal of steel and poly drums.

<sup>11</sup> Minimum 2 kilometer separation between new landfills and water wells.

<sup>12</sup> Daily cover soil must be at least 25 cm thick. Final grading of landfill must be no greater than 10 degrees slope.

<i>Petroleum, Oil, and Lubricants</i>	S
General POL Storage	S
Additional POL Storage	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

## Belgium – 2010

<i>Air Emissions</i> <sup>1</sup>	+
Boilers	S
Incinerators <sup>2</sup>	-
PCE Dry Cleaning <sup>3</sup>	+
Chromium Electroplating	S
Halogenated Solvent Cleaning <sup>4</sup>	+
O-zone Depleting Substances <sup>5</sup>	+
Motor Vehicles <sup>6</sup>	+
Stack Heights <sup>7</sup>	+

<i>Drinking Water</i> <sup>8</sup>	+
System	S
Coliform	S
Inorganic <sup>9</sup>	+
Fluoride <sup>10</sup>	+
Lead and Copper <sup>11</sup>	+
Synthetic Organics <sup>12</sup>	+
Disinfectant Byproduct Monitoring <sup>13</sup>	+
Radionuclide	S

<i>Wastewater</i>	S
Effluent Limitation conv <sup>14</sup>	+
Effluent Limitation non-cate indirect <sup>15</sup>	+
Effluent Limitation cate dischargers <sup>16</sup>	+
Storm Water	S

<sup>1</sup> Additional sections for regional criteria, fluorinated greenhouse gases, and installed heating units.

<sup>2</sup> FGS does not address emission standards for incinerators, just states that they must be permitted by HN authorities.

<sup>3</sup> PCE is not allowed in Belgium.

<sup>4</sup> Additional regional criteria for halogenated solvent cleaning machines.

<sup>5</sup> Must keep an inventory of all ODS. FGS has a list of prohibited ODS.

<sup>6</sup> Additional requirements for vehicles.

<sup>7</sup> Regional requirement for stack usage.

<sup>8</sup> Additional requirement that installations conduct risk assessments for Legionella and develop control measures.

<sup>9</sup> Additional chemicals in FGS and stricter MCLs for certain chemicals.

<sup>10</sup> Stricter fluoride levels.

<sup>11</sup> Stricter action level for lead

<sup>12</sup> Additional organic compounds and stricter MCLs for certain chemicals.

<sup>13</sup> Stricter maximum residual disinfectant level of chlorine.

<sup>14</sup> Stricter regional requirements for wastewater.

<sup>15</sup> Additional restrictions of compounds in wastewater. Corrosivity has to be between 6.5 and 9.0.

<sup>16</sup> Additional regional restrictions on categorical dischargers.

Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>17</sup>	+
Storage and Handling	S
Dispensing Areas <sup>18</sup>	+
Shipment	S
Master Listing <sup>19</sup>	+
Material Safety Data Sheets	S
HAZMAT management	S

<b><i>Hazardous Waste</i></b>	S
HW Generators	S
Accumulation Points	S
Storage Areas <sup>20</sup>	-
Containers	S
Record Keeping	S
Contingency Plan	S
Tank Systems <sup>21</sup>	+
Used Oil and Lead Acid Batteries <sup>22</sup>	+
Training	S
Disposal <sup>23</sup>	-

<b><i>Solid Waste</i></b> <sup>24</sup>	+
Solid Waste Management Plan <sup>25</sup>	+
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation	S
Open Burning	S

---

<sup>17</sup> Additional sections on Flemish region prohibited materials, specific storage conditions, secondary containment, and storage tank criteria.

<sup>18</sup> Additional requirements for dispensing area flooring and regional floor requirements.

<sup>19</sup> Inventories in Flemish region will be updated monthly.

<sup>20</sup> No mention of testing and maintenance of equipment. No specific mentioning of criteria ignitable, reactive, or incompatible wastes.

<sup>21</sup> Additional regional requirements for assessment of the integrity of existing tanks but there is no mention of design and installation of new tanks. FGS also has criteria for regional temporary storage of hazwaste.

<sup>22</sup> Stricter requirements for the burning of used oil and there is regional requirements for batteries.

<sup>23</sup> FGS does not mention specific criteria on landfills and incineration.

<sup>24</sup> Additional sections on animal waste, incineration of waste, and composting of yard waste.

<sup>25</sup> Additional regional requirements for materials separated for the purpose of recycling. Cannibalization of wrecked and scrapped vehicles is prohibited. Additional requirements for recycling in the Flemish region.

Composting Operations	S
Compost Usage <sup>26</sup>	+

<i>Petroleum, Oil, and Lubricants</i> <sup>27</sup>	+
General POL Storage criteria <sup>28</sup>	-
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

---

<sup>26</sup> Regional restrictions on composting operations and usage.

<sup>27</sup> Additional sections for tank terminals and filling stations.

<sup>28</sup> No mention of containment areas maximum permeability.

## Oman – 2012

<i>Air Emissions</i> <sup>1</sup>	+
Boilers	S
Incinerators	S
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances	S
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i> <sup>2</sup>	+
System <sup>3</sup>	+
Coliform <sup>4</sup>	+
Inorganic <sup>5</sup>	+
Fluoride <sup>6</sup>	S
Lead and Copper	S
Synthetic Organics <sup>7</sup>	+
Disinfectant Byproduct Monitoring <sup>8</sup>	+
Radionuclide <sup>9</sup>	+

<i>Wastewater</i> <sup>10</sup>	+
Effluent Limitation conv <sup>11</sup>	+
Effluent Limitation non-cate indirect <sup>12</sup>	S
Effluent Limitation cate dischargers	S

<sup>1</sup> Additional requirements for air emissions, ambient air quality standards, and prohibited substances.

<sup>2</sup> Additional sections on quality control for drinking water, organic biological properties, water treatment, water distributed by tanker vehicles, and sampling and testing.

<sup>3</sup> No pollutants shall be discharged to aflaj and their channels, surface watercourses, wadis or places of underground water recharge.

<sup>4</sup> Treated water entering the distribution system must be free of bacteria in any 100 mL sample.

<sup>5</sup> Stricter MCLs and more compounds added

<sup>6</sup> Fluoride MCL doesn't match between the text and the table that is referenced. **Inorganic chemicals table lists 1.5 mg/L as the MCL but the fluoride section states 4 mg/L is the MCL.**

<sup>7</sup> Stricter MCLs for some compounds and additional ones added.

<sup>8</sup> Stricter MCL for chlorite.

<sup>9</sup> Stricter MCL for Gross Alpha. Additional radionuclide concentration criteria

<sup>10</sup> FGS has additional sections on drains, traps, domestic wastewater treatment systems, use of wastewater for irrigation, liquid effluents, sewer discharges, and discharges to the marine environment.

<sup>11</sup> FGS doesn't use averages for BOD<sub>5</sub> and TSS, just MCLs. Existing and new sources must both follow the more stringent requirements.

<sup>12</sup> **FGS has same mistake as OEBGD (references subparagraphs that don't exist).**

Storm Water <sup>13</sup>	+
Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>14</sup>	+
Storage and Handling	S
Dispensing Areas <sup>15</sup>	+
Shipment	S
Master Listing	S
Material Safety Data Sheets	S
HAZMAT management	S

<b><i>Hazardous Waste</i></b>	S
HW Generators	S
Accumulation Points	S
Storage Areas	S
Containers <sup>16</sup>	+
Record Keeping <sup>17</sup>	+
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries	S
Training	S
Disposal <sup>18</sup>	+

<b><i>Solid Waste</i></b> <sup>19</sup>	+
Solid Waste Management Plan <sup>20</sup>	+
New Municipal Solid Waste Landfills <sup>21</sup>	+
Municipal Solid Waste Landfill Operation <sup>22</sup>	+
Open Burning	S
Composting Operations	S

<sup>13</sup> Additional requirements for storm water.

<sup>14</sup> Additional sections for packaging, transportation by land, and storage and handling.

<sup>15</sup> Additional requirements for containers in dispensing areas.

<sup>16</sup> Additional requirements for transporters to abide by hazardous waste labels and precautions.

<sup>17</sup> Manifests and waste analysis records must be kept for 5 years.

<sup>18</sup> Landfills must be designed to reduce leakage of wastes to soil or water and no dispersals due to wind. **Mistake in**

**C6.3.10.8.1.3. Biodegradation** – says “11W” instead of “HW”.

<sup>19</sup> Additional sections on sludge, importing waste, garbage collection rooms, landfill siting, and landfill equipment.

<sup>20</sup> Extra statement that solid non-hazardous waste shouldn't be mixed with hazardous waste.

<sup>21</sup> Additional requirement that only solid-nonhazardous waste shall be disposed of in landfills.

<sup>22</sup> Install ventilation systems to control release and disposal of gases.

Compost Usage	S
---------------	---

<i>Petroleum, Oil, and Lubricants</i>	S
General POL Storage criteria	S
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

## UAE – 2012

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators <sup>3</sup>	+
PCE Dry Cleaning	S
Chromium Electroplating <sup>4</sup>	+
Halogenated Solvent Cleaning	S
O-zone Depleting Substances <sup>5</sup>	+
Motor Vehicles <sup>6</sup>	+
Stack Heights <sup>7</sup>	+

<i>Drinking Water</i> <sup>8</sup>	+
System <sup>9</sup>	+
Coliform	S
Inorganic <sup>10</sup>	+
Fluoride <sup>11</sup>	+
Lead and Copper	S
Synthetic Organics <sup>12</sup>	+
Disinfectant Byproduct Monitoring <sup>13</sup>	+
Radionuclide <sup>14</sup>	+

<i>Wastewater</i> <sup>15</sup>	+
Effluent Limitation conv <sup>16</sup>	+
Effluent Limitation non-cate indirect <sup>17</sup>	+

<sup>1</sup> Additional sections of ambient air quality standards and emissions monitoring.

<sup>2</sup> Additional regional requirements.

<sup>3</sup> Additional incinerator criteria.

<sup>4</sup> Additional regional requirements for electroplating processes.

<sup>5</sup> Additional requirements and prohibited substances.

<sup>6</sup> Additional criteria for motor vehicles.

<sup>7</sup> Regional requirements for stacks.

<sup>8</sup> Additional regional criteria for drinking water in Abu Dhabi.

<sup>9</sup> Additional regional requirements for water suppliers and purification plants.

<sup>10</sup> Stricter MCLs for some chemicals and additional chemicals added.

<sup>11</sup> Stricter MCL for fluoride in drinking water.

<sup>12</sup> Stricter MCLs for organic chemicals and additional chemicals added.

<sup>13</sup> FGS has MCLs for trichloroacetic and dichloroacetic acids. Stricter MCL for chlorite.

<sup>14</sup> Stricter MCL for gross alpha.

<sup>15</sup> Additional sections for approvals of wastewater discharge and ambient standards.

<sup>16</sup> Stricter regional MCLs and criteria for discharges to Dubai creeks. Additional criteria for regional dischargers.

FGS has a list of prohibited substances for discharges to the marine environment and to land. Additional monitoring and recordkeeping requirements.

Effluent Limitation cate dischargers <sup>18</sup>	+
Storm Water <sup>19</sup>	+
Septic	S
Sludge <sup>20</sup>	+

<b><i>Hazardous Materials</i></b> <sup>21</sup>	+
Storage and Handling	S
Dispensing Areas	S
Shipment <sup>22</sup>	+
Master Listing	S
Labeling <sup>23</sup>	+
HAZMAT management <sup>24</sup>	+

<b><i>Hazardous Waste</i></b> <sup>25</sup>	+
HW Generators <sup>26</sup>	+
Accumulation Points	S
Storage Areas	S
Containers <sup>27</sup>	+
Record Keeping <sup>28</sup>	+
Contingency Plan <sup>29</sup>	+
Tank Systems	S
Used Oil and Lead Acid Batteries <sup>30</sup>	+
Training	S
Disposal <sup>31</sup>	+

<sup>17</sup> Specific regional criteria for discharges.

<sup>18</sup> Additional regional criteria for electroplating discharges.

<sup>19</sup> Additional storm water criteria for Jebel Ali.

<sup>20</sup> Additional regional criteria for sludge disposal.

<sup>21</sup> Additional sections of hazmat approval, secondary containment in Dubai, and hazmat segregation.

<sup>22</sup> Additional criteria vehicle transport and regional criteria for Dubai.

<sup>23</sup> FGS requires MSDS to identify if a chemical is also a reproductive toxin or target-organ systemic toxin for Abu Dhabi. Employers in Abu Dhabi must maintain MSDS in an electronic retrieval system or other such format that is easily accessible. Additional regional labeling criteria.

<sup>24</sup> HN employees must also be trained in HN Hazmat requirements.

<sup>25</sup> Additional sections on treatment of HW by HW generators, treatment and disposal location requirements, and HW approval.

<sup>26</sup> Additional waste characterization requirements in Dubai and transport requirements.

<sup>27</sup> Portable containers of HW will not be kept in common areas.

<sup>28</sup> The final destination for any transported waste must be kept on file for at least 3 years. Installation records of HW shall be kept for at 5 years from the commencement of the handling activity.

<sup>29</sup> FGS mandates emergency response plan to mitigate planned impacts during production, handling, transport, and storage of HW.

<sup>30</sup> Used oil in Dubai must be disposed of as HW.

<b><i>Solid Waste</i></b>	<b>S</b>
Solid Waste Management Plan <sup>32</sup>	+
New Municipal Solid Waste Landfills	<b>S</b>
Municipal Solid Waste Landfill Operation <sup>33</sup>	+
Open Burning	<b>S</b>
Composting Operations <sup>34</sup>	+
Compost Usage	<b>S</b>

<b><i>Petroleum, Oil, and Lubricants</i></b>	<b>S</b>
General POL Storage criteria	<b>S</b>
Additional POL storage criteria	<b>S</b>
Storage Container Wastes	<b>S</b>
General Transport and Distribution <sup>35</sup>	+
Personnel Training	<b>S</b>

---

<sup>31</sup> FGS specifies certain HW that should be recycled, re-used, or recovered. There are specific design standards for HW incinerators. Additional requirements for the location of HW treatment and disposal siting.

<sup>32</sup> Jebel Ali has additional requirements for the SWMP recycling.

<sup>33</sup> Additional regional requirements for using composting instead of landfilling or treatment prior to landfilling. Abu Dhabi landfills must implement programs to control wind-borne litter, dusts, leachates, and landfill gases. Abu Dhabi landfills use a suitable buffer distance from sensitive receptors and commercial areas. Fences around sites in Abu Dhabi. Abu Dhabi waste treatment facilities are required to keep records of waste produced, generated and transported.

<sup>34</sup> Additional requirements for Abu Dhabi composting operations.

<sup>35</sup> FGS requirements additional labeling for systems in Dubai.

## Netherlands – 2010

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators <sup>3</sup>	-
PCE Dry Cleaning <sup>4</sup>	+
Chromium Electroplating	S
Halogenated Solvent Cleaning	S
O-zone Depleting Substances <sup>5</sup>	+
Motor Vehicles <sup>6</sup>	+
Stack Heights	S

<i>Drinking Water</i>	S
System <sup>7</sup>	+
Coliform	S
Inorganic <sup>8</sup>	+
Fluoride <sup>9</sup>	S
Lead and Copper	S
Synthetic Organics <sup>10</sup>	+
Disinfectant Byproduct Monitoring	S
Radionuclide	S

<i>Wastewater</i> <sup>11</sup>	+
Effluent Limitation conv	S
Effluent Limitation non-cate indirect <sup>12</sup>	+

<sup>1</sup> Additional sections for fluorinated greenhouse gases, application of paints, kitchen facilities, wood-working facilities, VOC emission limits, and filling stations. (ERROR IN 2.3.9 – REFERENCE SOURCE NOT FOUND)

<sup>2</sup> Additional requirements for new or modified units.

<sup>3</sup> Lack of information on incinerators.

<sup>4</sup> PCE not allowed in the Netherlands.

<sup>5</sup> Additional size of leak monitoring. Additional criteria for HCFC and precautions to prevent leakage.

<sup>6</sup> Additional criteria for motor vehicles.

<sup>7</sup> Higher positive pressure in water system. Installations need to conduct Legionella risk assessments.

<sup>8</sup> Stricter MCLs and new MCLs.

<sup>9</sup> (ERROR IN FLUORIDE SECTION, TEXT DOES NOT MATCH REFERENCED TABLE).

<sup>10</sup> Stricter MCLs and new MCLs.

<sup>11</sup> Additional sections for kitchen wastewater, filling stations, vehicle washing facilities, and dental facilities.

<sup>12</sup> (ERROR IN REFERENCING NONEXISTANT PARAGRAPHS, MISTAKE FROM DELETING OEBGD MISTAKE). Additional criteria for wastewater that shall not be discharged into a public sewer.

Effluent Limitation cate dischargers	S
Storm Water	S
Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>13</sup>	+
Storage and Handling	S
Dispensing Areas <sup>14</sup>	+
Shipment	S
Master Listing	S
Material Safety Data Sheets <sup>15</sup>	+
HAZMAT management	S

<b><i>Hazardous Waste</i></b>	S
HW Generators	S
Accumulation Points	S
Storage Areas <sup>16</sup>	+
Containers <sup>17</sup>	+
Record Keeping	S
Contingency Plan	S
Tank Systems <sup>18</sup>	+
Used Oil and Lead Acid Batteries <sup>19</sup>	+
Training	S
Disposal <sup>20</sup>	-

<b><i>Solid Waste</i></b> <sup>21</sup>	+
Solid Waste Management Plan <sup>22</sup>	+

<sup>13</sup> Additional list with prohibited persistent organic pollutants. Also has very similar section of containers and AST as with HAZWASTE chapter.

<sup>14</sup> Additional requirements for dispensing areas.

<sup>15</sup> Additional requirements for maximum allowable concentration and identification of potential mutagens and teratogens. (ERROR, SPELLED TERATOGENS WRONG – FGS SPELLS IT TERRATOGENS)

<sup>16</sup> Additional requirements for compatible storage.

<sup>17</sup> Referenced to HAZMAT chapter, additional requirements for secondary containment.

<sup>18</sup> All tanks are required to have secondary containment, regardless of age or condition. Cathodic protection must be inspected with 3 months of installation.

<sup>19</sup> All batteries are handled as HW.

<sup>20</sup> Land-disposal and incinerators do not have information mandated in OEBGD.

<sup>21</sup> Solid waste generators must maintain a register of all wastes disposed and keep the records for 3 years.

<sup>22</sup> Additional requirements for solid waste management strategy.

New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation	S
Open Burning	S
Composting Operations <sup>23</sup>	+
Compost Usage <sup>24</sup>	+

<i>Petroleum, Oil, and Lubricants</i> <sup>25</sup>	+
General POL Storage criteria <sup>26</sup>	+
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	S
Personnel Training	S

---

<sup>23</sup> Composting facilities must comply, regardless of how much sludge is processed. Only the enclosed vessel method is allowed for composting.

<sup>24</sup> Additional requirements for composting usage.

<sup>25</sup> Additional section for POL Dispensing Facilities.

<sup>26</sup> Additional requirements for secondary containment and containment areas.

## Spain – 2008

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators <sup>3</sup>	+
PCE Dry Cleaning	S
Chromium Electroplating	S
Halogenated Solvent Cleaning <sup>4</sup>	+
O-zone Depleting Substances <sup>5</sup>	+
Motor Vehicles <sup>6</sup>	+
Stack Heights <sup>7</sup>	-

<i>Drinking Water</i> <sup>8</sup>	+
System <sup>9</sup>	+
Coliform <sup>10</sup>	+
Inorganic <sup>11</sup>	+
Fluoride <sup>12</sup>	+
Lead and Copper	S
Synthetic Organics <sup>13</sup>	+
Disinfectant Byproduct Monitoring <sup>14</sup>	-
Radionuclide <sup>15</sup>	+

---

<sup>1</sup> Installations must seek permits and permission to operate incinerators and thermal boiler units.

<sup>2</sup> Additional requirements for design greater than 1,000 MBtu/hr. Additional categories of size emission limits.

<sup>3</sup> Additional criteria for incinerators.

<sup>4</sup> 1,1,1-trichloroethane is no longer authorized for use.

<sup>5</sup> Additional requirements for ODS and more listed in tables.

<sup>6</sup> Additional requirements for vehicles.

<sup>7</sup> No mention of stack heights.

<sup>8</sup> Installations must label all non-potable water taps in buildings and there are additional permits and requests that must be submitted to Spanish authorities. Also has approved testing methods.

<sup>9</sup> Minimum distance between wells. Additional criteria for purchased and DoD-produced water. Additional criteria for residual disinfectants. Underground injection controlled by Spain authorities. Additional logbook requirements. Don't expand upon vulnerability assessments. Additional testing requirements for all water. NPWS must comply with PWS requirements. Stricter surface water treatment requirements.

<sup>10</sup> Stricter requirements for monitoring.

<sup>11</sup> Requirements for purchased and produced water and stricter MCLs.

<sup>12</sup> Stricter MCL of fluorine in water. Stricter upper control limits.

<sup>13</sup> Stricter MCLs and added MCLs.

<sup>14</sup> FGS does not mention any other disinfectants and has a higher MCL than OEBGD. Also has less strict monitoring requirements for less than 10,000 people.

<b><i>Wastewater</i></b>	<b>S</b>
Effluent Limitation conv <sup>16</sup>	+
Effluent Limitation non-cate indirect <sup>17</sup>	+
Effluent Limitation cate dischargers <sup>18</sup>	+
Storm Water <sup>19</sup>	+
Septic	<b>S</b>
Sludge	<b>S</b>

<b><i>Hazardous Materials</i></b> <sup>20</sup>	+
Storage and Handling <sup>21</sup>	+
Dispensing Areas <sup>22</sup>	+
Shipment <sup>23</sup>	+
Master Listing	<b>S</b>
Material Safety Data Sheets	<b>S</b>
HAZMAT management <sup>24</sup>	+

<b><i>Hazardous Waste</i></b> <sup>25</sup>	+
HW Generators	<b>S</b>
Accumulation Points <sup>26</sup>	+
Storage Areas <sup>27</sup>	+
Containers <sup>28</sup>	+
Record Keeping <sup>29</sup>	+
Contingency Plan	<b>S</b>
Tank Systems <sup>30</sup>	+

<sup>15</sup> FGS doesn't have uranium MCLs but has requirements for produced and purchased water and adds tritium.

<sup>16</sup> Additional requirements for discharges to seas and continental waters.

<sup>17</sup> Stricter pH level for corrosivity.

<sup>18</sup> Only daily maximum amounts used in FGS. Stricter daily maximum allowable limits.

<sup>19</sup> Additional requirements for storm water management.

<sup>20</sup> Additional criteria for prohibited and restricted use products.

<sup>21</sup> Require approval from HN authorities.

<sup>22</sup> Additional requirement for a sump or basin to collect spills.

<sup>23</sup> Drivers must be ADR certified

<sup>24</sup> Minimum requirements for training and additional training criteria.

<sup>25</sup> Bases must prepare a waste minimization study every 4 years.

<sup>26</sup> Waste must be moved within 6 months.

<sup>27</sup> Additional requirements and waste should not be stored for more than 6 months.

<sup>28</sup> Minimum requirements for container labeling.

<sup>29</sup> Records must be maintained for 5 years.

<sup>30</sup> All tanks must have a secondary containment system.

Used Oil and Lead Acid Batteries <sup>31</sup>	+
Training	S
Disposal <sup>32</sup>	+

<i>Solid Waste</i> <sup>33</sup>	+
Solid Waste Management Plan <sup>34</sup>	+
New Municipal Solid Waste Landfills	S
Municipal Solid Waste Landfill Operation <sup>35</sup>	+
Open Burning	S
Composting Operations <sup>36</sup>	+
Compost Usage <sup>37</sup>	+

<i>Petroleum, Oil, and Lubricants</i>	S
General POL Storage criteria <sup>38</sup>	+
Additional POL storage criteria <sup>39</sup>	-
Storage Container Wastes	S
General Transport and Distribution <sup>40</sup>	S
Personnel Training <sup>41</sup>	-

---

<sup>31</sup> Additional requirements for burning used oil.

<sup>32</sup> Need HN approval to do on-base HW recovery/recycling. Stricter landfill requirements. Additional incinerator requirements. Even after treatment, HW cannot be disposed of as solid waste.

<sup>33</sup> Installations must report any facilities that perform sludge treatment.

<sup>34</sup> (ERROR – DATE OF JULY 2009 IS REPEATED TWICE WITH TWO DIFFERENT STANDARDS).

Requirement for the amount of time non-hazwaste can be stored.

<sup>35</sup> It is prohibited to dispose of tires in a MSWLF. Post closure period for MSWLF is at least 30 years.

<sup>36</sup> Additional requirements for agricultural purposes.

<sup>37</sup> Additional requirements for compost usage.

<sup>38</sup> Additional secondary containment and other requirements.

<sup>39</sup> No mention.

<sup>40</sup> Additional requirements for testing of pipeline facilities but no mention of load/unloading areas.

<sup>41</sup> No mention.

## Portugal – 2011

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators <sup>3</sup>	+
PCE Dry Cleaning <sup>4</sup>	+
Chromium Electroplating	S
Halogenated Solvent Cleaning <sup>5</sup>	+
O-zone Depleting Substances <sup>6</sup>	+
Motor Vehicles	-
Stack Heights	S

<i>Drinking Water</i>	S
System <sup>7</sup>	+
Coliform <sup>8</sup>	+
Inorganic <sup>9</sup>	+
Fluoride <sup>10</sup>	+
Lead and Copper	S
Synthetic Organics <sup>11</sup>	+
Disinfectant Byproduct Monitoring	S
Radionuclide <sup>12</sup>	+

<i>Wastewater</i> <sup>13</sup>	+
Effluent Limitation conv <sup>14</sup>	+
Effluent Limitation non-cate indirect <sup>15</sup>	+

---

<sup>1</sup> Additional sections on combustion of used oil and vapor recovery.

<sup>2</sup> Criteria apply to a larger range of design heat capacity. Additional criteria for boiler units.

<sup>3</sup> Local permits requirements override OEBGD.

<sup>4</sup> All PCE dry cleaning must be dry-to-dry design. Additional criteria for machines using organic solvents.

<sup>5</sup> Additional criteria for machines using organic solvents

<sup>6</sup> Additional prohibited criteria and stricter limits of ODS requiring repairs.

<sup>7</sup> Minimum requirements in master plan. Additional requirements for wells. Underground injection is prohibited. Additional requirements to notify HN commander of all tests.

<sup>8</sup> Stricter criteria for exceeding MCL. Additional requirements to test for other stuff in the water.

<sup>9</sup> Stricter MCLs and additional MCLs.

<sup>10</sup> Stricter MCL and stricter upper control limit.

<sup>11</sup> Stricter MCLs and additional MCLs.

<sup>12</sup> Stricter MCLs and adds two more parameters.

<sup>13</sup> Additional requirements for the discharges of wastewater. Additional section on dental facilities.

<sup>14</sup> Stricter MCLs and additional requirements.

<sup>15</sup> Additional requirements and prohibited to discharge radioactive pollutants.

Effluent Limitation cate dischargers <sup>16</sup>	S
Storm Water	S
Septic	S
Sludge	S

<b><i>Hazardous Materials</i></b> <sup>17</sup>	+
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Material Safety Data Sheets	S
HAZMAT management	S

<b><i>Hazardous Waste</i></b>	S
HW Generators <sup>18</sup>	+
Accumulation Points	S
Storage Areas <sup>19</sup>	+
Containers	S
Record Keeping <sup>20</sup>	+
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries <sup>21</sup>	+
Training	S
Disposal <sup>22</sup>	-

<b><i>Solid Waste</i></b> <sup>23</sup>	+
Solid Waste Management Plan <sup>24</sup>	+
New Municipal Solid Waste Landfills <sup>25</sup>	+

<sup>16</sup> No requirements but also mentions that none are active and installation should contact EEA for guidance.

<sup>17</sup> Additional sections on HAZMAT criteria and banned materials.

<sup>18</sup> Additional requirements for transportation of HW.

<sup>19</sup> Additional criteria for required equipment.

<sup>20</sup> Manifests of HW shipped off-site must be kept for 5 years.

<sup>21</sup> Additional requirements for used oil and batteries.

<sup>22</sup> No mention of treatment technologies and only mentions that landfilling is only allowed in permitted landfills with no further restrictions.

<sup>23</sup> Additional requirements for other SW and animal by-products.

<sup>24</sup> Additional requirements for SWMP.

<sup>25</sup> Additional criteria for MSWLF.

Municipal Solid Waste Landfill Operation <sup>26</sup>	+
Open Burning <sup>27</sup>	+
Composting Operations	S
Compost Usage	S

<b><i>Petroleum, Oil, and Lubricants</i></b> <sup>28</sup>	+
General POL Storage criteria	+
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution	+
Personnel Training	S

---

<sup>26</sup> Additional criteria for operations and gas must be flared if not captured. Stricter closure operations.

<sup>27</sup> Opening burning is not permitted.

<sup>28</sup> Additional requirements for gas stations.

## United Kingdom – 2013

<i>Air Emissions</i> <sup>1</sup>	+
Boilers <sup>2</sup>	+
Incinerators <sup>3</sup>	+
PCE Dry Cleaning <sup>4</sup>	+
Chromium Electroplating <sup>5</sup>	+
Halogenated Solvent Cleaning <sup>6</sup>	+
O-zone Depleting Substances <sup>7</sup>	+
Motor Vehicles	S
Stack Heights	S

<i>Drinking Water</i>	S
System <sup>8</sup>	+
Coliform <sup>9</sup>	+
Inorganic <sup>10</sup>	+
Fluoride <sup>11</sup>	+
Lead and Copper <sup>12</sup>	+
Synthetic Organics <sup>13</sup>	+
Disinfectant Byproduct Monitoring	S
Radionuclide	S

<sup>1</sup> Additional sections on VOC emissions for facilities exceeding solvent consumption thresholds, fuel criteria, and vapor-recovery units.

<sup>2</sup> Additional criteria that units must not produce black smoke (with exception).

<sup>3</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements. Criteria for minimum temperature in primary chambers. Additional emission standards for incinerators. **ERROR IN C2.T3 (955 INSTEAD OF 95%).**

<sup>4</sup> Additional requirements for dry cleaners using VOCs.

<sup>5</sup> Requirement that bases with a combined tank capacity greater than 30 m<sup>3</sup> must contact HN to see if there are more stringent permitting requirements.

<sup>6</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements and limits for solvent consumption.

<sup>7</sup> Section on the prohibited uses of ODS and exceptions. Additional requirements for equipment containing different sizes of ODS and leak detection. Halon fire suppression systems must be decommissioned.

<sup>8</sup> Vulnerability assessments are conducted once every 5 years.

<sup>9</sup> Required monitoring of Enterococci.

<sup>10</sup> Additional requirements and stricter MCLs and additional MCLs.

<sup>11</sup> Lower upper control limit for fluoride. Additional requirements for fluoride in water.

<sup>12</sup> Additional requirements and lower action level for lead after 25 Dec 2013.

<sup>13</sup> Stricter MCLs and additional MCLs. Additional regional criteria.

<b>Wastewater</b> <sup>14</sup>	+
Effluent Limitation conv <sup>15</sup>	+
Effluent Limitation non-cate indirect <sup>16</sup>	+
Effluent Limitation cate dischargers <sup>17</sup>	+
Storm Water	S
Septic <sup>18</sup>	+
Sludge	S

<b>Hazardous Materials</b> <sup>19</sup>	+
Storage and Handling	S
Dispensing Areas	S
Shipment	S
Master Listing	S
Material Safety Data Sheets	S
HAZMAT management	S

<b>Hazardous Waste</b>	S
HW Generators <sup>20</sup>	+
Accumulation Points	S
Storage Areas <sup>21</sup>	+
Containers <sup>22</sup>	+
Record Keeping	S
Contingency Plan	S
Tank Systems	S
Used Oil and Lead Acid Batteries <sup>23</sup>	+
Training	S
Disposal <sup>24</sup>	+

---

<sup>14</sup> Additional requirement for wastewater system operators.

<sup>15</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements.

<sup>16</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements.

<sup>17</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements.

<sup>18</sup> Septic systems that discharge more than 2 m<sup>3</sup> a day need a permit.

<sup>19</sup> Additional chemicals listed that are not allowed on the installation. Additional hazardous material criteria.

<sup>20</sup> Additional criteria for HW generators.

<sup>21</sup> Additional requirement for the segregation of persistent organic pollutants.

<sup>22</sup> Secondary containment requirement is more stringent and drain must be in a locked position.

<sup>23</sup> Additional criteria for used oil and batteries.

<sup>24</sup> Land disposal should be a last resort. Additional disposal requirements.

<b><i>Solid Waste</i></b> <sup>25</sup>	+
Solid Waste Management Plan <sup>26</sup>	+
New Municipal Solid Waste Landfills <sup>27</sup>	+
Municipal Solid Waste Landfill Operation <sup>28</sup>	+
Open Burning	S
Composting Operations <sup>29</sup>	+
Compost Usage <sup>30</sup>	+

<b><i>Petroleum, Oil, and Lubricants</i></b>	S
General POL Storage criteria <sup>31</sup>	+
Additional POL storage criteria	S
Storage Container Wastes	S
General Transport and Distribution <sup>32</sup>	+
Personnel Training	S

---

<sup>25</sup> Additional sections of disposing of solid waste, animal by-products, and end-of-life vehicles.

<sup>26</sup> Used cooking oil containers meet the criteria for POL. Installations shall use all means feasible to separate waste paper, metals, plastics, and glass. Additional criteria for punctured aerosol cans.

<sup>27</sup> Additional criteria for new landfills.

<sup>28</sup> Additional criteria for landfill operations and control of methane gas. Stricter closure operations.

<sup>29</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements.

<sup>30</sup> Requirement that bases must contact HN to see if there are more stringent permitting requirements.

Installations that provide class A compost have additional criteria.

<sup>31</sup> Additional general requirements for POL and stricter POL applicability.

<sup>32</sup> Additional requirements for transportation and loading/unloading.

## Bibliography

- Baker, P., Murley, J., & Pickenpaugh, J. (2012). A Comparison of DOD Environmental Standards at US Military Bases in Japan, the Republic of Korea, and Germany. *unpublished*.
- Bernauer, T., & Boehmelt, T. (2013). Are Economically "Kinder, Gentler Societies" Also Greener? *Environmental Science & Technology*.
- Commander, Navy Region Europe. (2008). *Environmental Final Governing Standards: Spain*.
- Commander, Navy Region Europe, Africa, Southwest Asia. (2012). *Environmental Final Governing Standards: Italy*.
- Emerson, J. W., Hsu, A., Levy, M. A., de Sherbinin, A., Mara, V., Etsy, D. C., et al. (2012). *EPI 2012 Environmental Performance Index and Pilot Trend Environmental Performance Index*. Yale University, Columbia University. New Haven: Yale Center for Environmental Law and Policy.
- Etsy, D. C., Levy, M., Srebotnjak, T., & de Sherbinin, A. (2005). *2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship*. New Haven: Yale Center for Environmental Law & Policy.
- Headquarters, U.S. Forces Japan. (2012). *Japan Environmental Governing Standards*.
- Headquarters, United States Air Forces Europe. (2008). *Final Governing Standards for the Republic of Turkey*.
- Headquarters, United States Air Forces Europe. (2011). *Final Governing Standards for Portugal*.
- Headquarters, United States Air Forces Europe. (2013). *Final Governing Standards for the United Kingdom*.
- Headquarters, United States Forces Korea. (2012). *Environmental Governing Standards*.
- Hershfield, H. E., Bang, H. M., & Weber, E. U. (2013). National Differences in Environmental Concern and Performance Are Predicted by Country Age. *Psychological Science*.

- Jha, R., & Murthy, K. B. (2003). *A Critique of the Environmental Sustainability Index*. Working Paper, Australian National University Division of Economics.
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). *The Worldwide Governance Indicators: Methodology and Analytical Issues*. The World Bank, Macroeconomics and Growth Team.
- Keeping Score. (2001). *Ecologist*, 31(3), pp. 44-47.
- Kwon, O. Y. (2013). Troubled Two Asian Tigers, Korea and Taiwan: Why Cannot They Cross over the Threshold of Advanced Economies? *International Proceedings of Economics Development and Research*, 65(11).
- Langbein, L., & Knack, S. (2010, February). The Worldwide Governance Indicators: Six, One, or None? *Journal of Development Studies*, 46(2), 350-370.
- Lester, J. P. (1994). A New Federalism? Environmental Policy in the States. In N. Vig, & M. E. Kraft, *Environmental Policy in the 1990s: Toward a New Agenda* (2nd ed., pp. 51-68). Washington D.C.: Congressional Quarterly Inc.
- Lio, M., & Liu, M.-C. (2008, December). Governance and agricultural productivity: A cross-national analysis. *Food Policy*, 33(6), 504-512.
- Morse, S., & Fraser, E. D. (2005, September). Making 'dirty' nations look clean? The nation state and the problem of selecting and weighting indices as tools for measuring progress towards sustainability. *Geoforum*, 36(5), 625-640.
- Obama, B. H. (2011, November 17). *Remarks by President Obama to the Australian Parliament*. Retrieved February 23, 2014, from WhiteHouse.gov: <http://www.whitehouse.gov/the-press-office/2011/11/17/remarks-president-obama-australian-parliament>
- Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. (2007). *Overseas Environmental Baseline Guidance Document*.
- Panetta, L. E. (2012). *Secretary of Defense Speech at the Shangri-La Security Dialogue*. Retrieved February 1, 2014, from Defense.gov: <http://www.defense.gov/utility/printitem.aspx?print=http://www.defense.gov/speeches/speech.aspx?speechid=1681>

- Ragasa, C., Sun, Y., Bryan, E., Abate, C., Alemu, A., & Keita, M. N. (2013). *Organizational and Institutional Issues in Climate Change Adaptation and Risk Management: Insights from Practitioners' Survey in Bangladesh, Ethiopia, Kenya, and Mali*. Development Strategy and Governance Division. International Food Policy Research Institute.
- Smith, J. M. (1997, June). Environmental Federalism and U.S. Military Installations: A Framework for Compliance. Colorado: Institute for National Security Studies, U.S. Air Force Academy.
- The World Bank Group. (2013). *Interactive Data Access*. Retrieved from Worldwide Governance Indicators:  
<http://info.worldbank.org/governance/wgi/index.aspx#reports>
- Thomas, M. A. (2010). What Do the Worldwide Governance Indicators Measure? *European Journal of Development Research*, 22, 31-54.
- U.S. Air Forces Central. (2010). *Kingdom of Saudi Arabia Final Governing Standards*.
- U.S. Air Forces Central. (2011). *State of Qatar Final Governing Standards*.
- U.S. Air Forces Central. (2012). *Sultanate of Oman Final Governing Standards*.
- U.S. Navy Central Command. (2012). *United Arab Emirates Final Governing Standards*.
- United Nations. (2000). *United Nations Millennium Declaration*. Resolution, United Nations.
- United States Army Central Command. (2011). *Kuwait Environmental Final Governing Standard*.
- United States Army: Installation Management Command - Europe. (2010a). *Environmental Final Governing Standards: Belgium*.
- United States Army: Installation Management Command - Europe. (2010b). *Environmental Final Governing Standards: Germany*.
- United States Army: Installation Management Command - Europe. (2010c). *Environmental Final Governing Standards: Netherlands*.

Vachon, S. (2012, December). Technological Capacity and Environmental Performance: A Research Note Using Country Level Data. *Journal of Operations and Supply Chain Management*, 21-28.

Yale University. (2012). *2012 & Trend EPI: Country Profiles*. Retrieved from Environmental Performance Index: <http://epi.yale.edu/epi2012/countryprofiles>

<b>REPORT DOCUMENTATION PAGE</b>			<i>Form Approved</i> <i>OMB No. 074-0188</i>	
The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.				
<b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b>				
<b>1. REPORT DATE (DD-MM-YYYY)</b> 28-03-2014		<b>2. REPORT TYPE</b> Master's Thesis		<b>3. DATES COVERED (From - To)</b> Aug 2012 - Mar 2014
<b>4. TITLE AND SUBTITLE</b> A MODEL TO GUIDE DEVELOPMENT OF ENVIRONMENTAL FINAL GOVERNING STANDARDS FOR OVERSEAS UNITED STATES DEPARTMENT OF DEFENSE INSTALLATIONS			<b>5a. CONTRACT NUMBER</b>	
			<b>5b. GRANT NUMBER</b>	
			<b>5c. PROGRAM ELEMENT NUMBER</b>	
			<b>5d. PROJECT NUMBER</b>	
			<b>5e. TASK NUMBER</b>	
			<b>5f. WORK UNIT NUMBER</b>	
<b>6. AUTHOR(S)</b> Marshall, R. Sean, Captain, USAF				
<b>7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)</b> Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/ENV) 2950 Hobson Way, Building 640 WPAFB OH 45433-8865			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> AFIT-ENV-14-M-37	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Intentionally Left Blank			<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
			<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> Distribution Statement A. Approved for Public Release; Distribution Unlimited				
<b>13. SUPPLEMENTARY NOTES</b> This material is declared a work of the U.S. Government and is not subject to copyright protection in the United States.				
<b>14. ABSTRACT</b> The Overseas Environmental Baseline Guidance Document (OEBGD) establishes the baseline environmental standards for United States (U.S.) forces operating overseas and is the template for the development of Environmental Final Governing Standards (FGS). FGS are required at any long-term U.S. installation and set the standard of environmental compliance for U.S. forces in each individual country. The purpose of this research is to analyze the FGS of different countries and compare their requirements to the OEBGD requirements. The individual FGS were scored according to if sections were more stringent, less stringent or the same as the OEBGD. The countries analyzed were then plotted in a model of environmental performance and governance called the Lester Model. The Lester Model categorizes the countries according to their environmental performance and governance scores. While the results did not indicate that a country's position in the Lester Model has a strong relationship with the overall strictness of the FGS, the analysis did identify a number of mistakes in the FGS. The mistakes found ranged from spelling errors to formatting mistakes to inconsistent references.				
<b>15. SUBJECT TERMS</b> Final Governing Standards, Overseas Environmental Baseline Guidance Document, Environmental Performance Index, World Governance Indicators, Lester Model				
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>  UU	<b>18. NUMBER OF PAGES</b>  118
<b>a. REPORT</b>  U	<b>b. ABSTRACT</b>  U	<b>c. THIS PAGE</b>  U		
			<b>19b. TELEPHONE NUMBER (Include area code)</b> (937) 255-3636, x 4528 (Willie.harper@afit.edu)	