

Responding to Environmental Challenges in Central Asia and the Caspian Basin

March 2001



United States
Central Command



United States
Department of Defense



George C. Marshall
European Center
for Security Studies



United States
Army War College
Center for Strategic Leadership

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The editors wish to thank LTC (GEA) Wolfgang Blum, Ms. Peg Rothwell, Dr. William Stivers, and all of the team from Conference Division A at the George C. Marshall European Center for Security Studies for their assistance in planning and running this conference.

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March 2001

PREFACE



May 2nd, 2001

On behalf of the U.S. Central Command, the Deputy Under Secretary of Defense for Environmental Security, the George C. Marshall European Center for Security Studies, and the U.S. Army War College, I would like to thank all concerned for their participation in the Environmental Security Conference for Central Asia and the Caspian Basin in Garmisch-Partenkirchen, Germany.

This was the second environmental security conference for the Central Command areas of responsibility. It examined critical environmental issues of common interest bringing together senior military and civilian leaders from the Central Asia and the Caspian Basin states, international academics, the private sector, governmental and military subject matter experts, and the World Bank Group in an atmosphere of mutual cooperation and respect. I believe that it achieved its purpose by identifying environmental threats to regional security and emphasizing the importance of both military environmental stewardship and cooperative contingency planning in responding to these threats.

Enclosed you will find a summary of the events of the conference as well as the detailed papers and presentations of the symposium.

Respectfully,

A handwritten signature in black ink, appearing to read 'TFRANKS', written over a faint, stylized graphic element.

TOMMY R. FRANKS
General, USA
Commander in Chief
U.S. Central Command

TABLE OF CONTENTS

| | |
|-----------------------------------------------------------------------------------------|------|
| PREFACE – General Tommy Franks | iii |
| TABLE OF CONTENTS | v |
| FORWARD – Professor Doug Campbell | ix |
| EXECUTIVE SUMMARY | xi |
| CHAPTER 1 - <i>Introduction</i> | 1-1 |
| <i>Opening Remarks</i> Oberst Franz-Xaver Lauterer | 1-2 |
| <i>Opening Remarks</i> Lieutenant General Michael P. Delong | 1-3 |
| <i>Opening Remarks</i> Mr. Curtis Bowling | 1-6 |
| <i>Intelligence Estimate</i> Mr. Clifford Fowler | 1-9 |
| CHAPTER 2 - <i>Global Focus: Defining the Issues</i> | 2-1 |
| Moderated by Dr. Kent Hughes Butts | |
| <i>Defining Environmental Security</i> Dr. Kent Hughes Butts | 2-3 |
| <i>Learning from the Valdez Oil Spill</i> Vice Admiral Clyde Robbins, USCG (Retired) | 2-25 |
| <i>Mozambique Floods</i> Mr. L.J. Buys | 2-33 |
| CHAPTER 3 - <i>Regional Focus: National Experiences</i> | 3-1 |
| Moderated by Dr. Bryan Shaw | |
| <i>Caspian Basin Analysis</i> Dr. Bryan Shaw | 3-3 |

Responding to Environmental Challenges in Central Asia and the Caspian Basin

World Bank 3-67
Mr. David Pearce

Organization for Economic Cooperation in Europe-OSCE 3-71
Ambassador Marin Buhoara (Romania)

Kazakhstan - National Experiences 3-75
MG Uraz K. Rakyshev

Kyrgystan - National Experiences 3-79
A. Sarnogoev

Tajikistan - National Experiences 3-81
COL Bakhrom Mamadaliev

Turkmenistan - National Experiences 3-87
COL Rafik Turayev

Uzbekistan - National Experiences 3-91
COL Rinat Zalyaletdinov

Papers

*A Systematic Approach to the Problem of Harmonizing
Military Activity in Preserving Ecological Security* 3-95
COL Pernehan Yermekbaev

*Contemporary Geotectonic State of the Aral Sea Basin
and Associated Natural Processes* 3-97
Mr. Anvar Nurhodjaev

CHAPTER 4 - National Focus: Military's Role In Environmental Security 4-1

Moderated by Mr. Curtis Bowling

*Military Roles in Environmental Security: Military
Stewardship* 4-3
Mr. Curtis Bowling

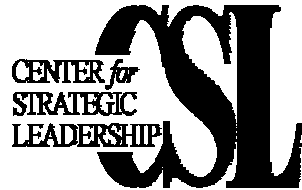
*Reasonable Military Actions for Mitigating
Environmental Damage* 4-5
Major General Dennis Jackson

Earthquakes in Turkey 4-15
Brigadier General Ali Fuat Sarac

Responding to Environmental Challenges in Central Asia and the Caspian Basin

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------|------|
| <i>Military Environmental Stewardship in the Philippines</i> Colonel Victor Corpus | 4-31 |
| CHAPTER 5 – <i>Military Response & Support to Civilian Authorities</i> <i>Moderated by Rear Admiral Gaidis A. Zeibots</i> | 5-1 |
| <i>Military Response and Support to Civilian Authorities</i> Rear Admiral Gaidis A. Zeibots | 5-3 |
| <i>Hurricane Mitch Scene Setter</i> Dr. William Bertrand | 5-9 |
| <i>Disaster Response Planning</i> Mr. Wolfgang Krajic | 5-27 |
| <i>Military Support to Civilian Authorities</i> Colonel Bruce Bodin | 5-35 |
| <i>Military Medical Support to Environmental Security and Disaster Response</i> Commander Michael A. Sircy | 5-41 |
| CHAPTER 6 – <i>Crisis Management Exercise (CMX)</i> <i>Professor Bernard F. Griffard (Exercise Director)</i> | 6-1 |
| APPENDIX A - ATTENDEE LIST | A-1 |
| APPENDIX B - AGENDA | B-1 |

FOREWORD



“Responding to Environmental Challenges in Central Asia and the Caspian Basin” was a USCENTCOM conference cosponsored by the Office of the Deputy Under Secretary of Defense for Environmental Security (DUSD-ES), the Center for Strategic Leadership (CSL) of the U.S. Army War College, and the George C. Marshall European Center for Security Studies, and hosted by the Marshall Center in Garmisch-Partenkirchen, Germany. This conference brought together senior military and civilian leaders for the Central Asia and the Caspian Basin states, international academics, the private sector, governmental and military subject matter experts, and non-governmental organizations to examine critical environmental issues that affect the security of the region. The conference focused on how the region’s military can play a meaningful role in maintaining and improving the environment and responding to natural and man-made disasters. It also demonstrated how these efforts might promote a closer working relationship with USCENTCOM and create new roles of military support to civil authority.

To do so, one must understand how the militaries can lessen their impact on environmental quality without compromising their ability to execute their missions. Raising awareness of the military impact on the environment helps facilitate necessary behavioral and cultural changes. It then becomes possible to shift the impact of military activity from having a negative effect to being neutral and ultimately to having a positive effect on the environment.

One must also consider the ways that the military can support civil authorities. Organizing and conducting disaster response operations, regular training exercises, data exchanges, assisting them with their own programs for scientific sampling and monitoring of environmental quality, and other peacetime activities offer the opportunity to engage host nation militaries and support their civilian governments.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

This conference made a valuable contribution to the shaping mission of the regional CINCs. It demonstrated the broad scope of environmental security issues and showed their unique value as tools of engagement for this strategically important region. Enhancing the role of the military in disaster response offers opportunities for the CINCs to engage their regional partners and promote regional security and stability.

Professor Douglas B. Campbell
Director, Center for Strategic Leadership
U.S. Army War College

EXECUTIVE SUMMARY

Following the success of the Environmental Security Conference held in Oman in April 2000, U.S. Central Command conducted an Environmental Security Conference for Central Asia and the Caspian Basin from March 6-8, 2001 in Garmisch-Partenkirchen, Germany. The event was cosponsored by the Office of the Deputy Under Secretary of Defense for Installations and Environment (DUSD-I&E), the George C. Marshall European Center for Security Studies, and the Center for Strategic Leadership (CSL) of the U.S. Army War College.

The conference brought together regional military and civilian leaders from Kazakhstan, Kyrgystan, Tajikistan, Turkmenistan, and Uzbekistan; military representatives from Turkey, Latvia, and the Philippines; international academics; the private sector; governmental and military subject matter experts; the Organization for Security and Cooperation in Europe (OSCE); NATO's Euro-Atlantic Disaster Response Cooperation Center (EADRCC); and the World Bank Group to examine critical environmental issues directly related to regional security.

The objectives of the conference were to:

- Clarify how environmental issues are central to the security of the region with the potential to create tensions or promote multilateral cooperation;
- Identify major regional environmental challenges;
- Demonstrate how the military's environmental security responsibilities promote regional stability;
- Explore areas for military regional cooperation;
- Identify other activities that promote regional cooperation and enhance peaceful engagement; and
- Establish Environmental Security as a primary avenue of assurance between and among CENTCOM and the region's military forces.

OPENING REMARKS AND COMMENTS

The tone of the conference was set early during opening remarks by reaffirming a common understanding that Environmental Security is a transnational problem that requires multilateral, regional solutions.

The first presentation highlighted existing and emerging Environmental Security threats in the region. These include water scarcity and quality, competition for natural resources, deteriorating infrastructure (there was a general discussion regarding the state of the Aral and Caspian Seas), contamination from uranium tailings in various countries, aging fast breeder reactors, and the potential for natural and manmade disasters. This was followed by presentations on the threats to security caused by destruction of the Aral Sea and important environmental changes to the Caspian Sea. An important point here was that the legitimacy of regional governments turns on their ability to meet their population's demand for resources and mitigate the impact of environmental problems.

There are a growing number of agreements that reflect an awareness of the importance of these issues by addressing some potentially destabilizing Environmental Security threats. For example, Uzbekistan and Kazakhstan need water for irrigation in the summer; however, Kyrgyzstan needs to release water in the winter to obtain hydropower for the cold months. Uzbekistan and Kazakhstan agreed to provide other energy resources such as coal, oil (Kazakhstan), and gas (Uzbekistan) to Kyrgyzstan in the winter and Kyrgyzstan agreed to hold water releases. The results of this agreement in practice, however, have not entirely met what was envisioned. The lack of institutions in the area to deal with these problems, the minimal agreements concluded, and scarce government monetary support to maintain infrastructure have diminished efforts at implementation. Nonetheless, regional governments continue to collectively address regional issues, such as establishing the Aral Sea Salvation Foundation. The question is: what is the role of the military in enhancing civil authority's efforts to resolve these problems?

DEFINING THE ISSUES

The first Panel discussions had a global focus and began by defining Environmental Security and its multiple dimensions (Chapter 2). The Panel also examined case studies on the Exxon-Valdez Oil Spill and the Mozambique floods. The accepted definition of Environmental Security:

Responding to Environmental Challenges in Central Asia and the Caspian Basin

When environmental issues affect national security interests they become security concerns. Environmental Security typically deals with the quality and quantity of resources necessary to sustain the country's security interests. Countries will normally act to protect the resource base necessary to preserve their national vitality.

- *Pollution, which many identify as the focus of Environmental Security, is relevant because it reduces the resource base available to meet the needs of a state's population.*
- *Similarly, natural and manmade disasters, soil erosion, over-fishing, and nuclear issues may affect resource availability and promote disease or famine.*
- *More traditional security threats occur when other actors threaten to limit a country's ability to import resources or over-consume commonly held resources. Oil supply disruption, the upstream damming or diversion of rivers, illegal timber harvesting, and fishing within another country's territorial waters exemplify the phenomenon.*

As this definition and the U.S. National Security Strategy make clear, environmental issues are central to regional stability and conflict resolution. They threaten U.S. national security interests, are global in nature, and are, therefore, an important dimension of any U.S. effort to shape global security.

NATIONAL EXPERIENCES

The second Panel discussions had a more regional focus (Chapter 3). It began with a detailed analysis of the environmental challenges in the Caspian Basin and included presentations from The World Bank and the Organization for Security and Cooperation in Europe (OSCE). The Panel concluded with discussions on the national experiences of each of the Central Asian states.

One key point addressed was that the exploitation of oil and gas resources will drive the relations in this region during the next century. These nonrenewable resources are vital to the economies of both developing and developed nations. Therefore, the region and other stakeholders collectively need to move from analysis to action now.

There are differences between the Exxon-Valdez case study and the Caspian. The environment in the Caspian is already considerably burdened – it is not pristine, as in the case of Alaska. There is a different legal environment as well. These countries are young with developing legal systems. Additionally, there are cultural and

Responding to Environmental Challenges in Central Asia and the Caspian Basin

values differences between the U.S. and the Caspian region. All of these influence the definition of "clean." Finally, an oil spill in the Caspian would be more complicated than the Exxon-Valdez due to the number of affected and interested states.

The World Bank and OSCE presentations yielded some engaging discussion. Many of the regional water problems, including the Aral Sea, were a result of Soviet irrigation projects along the rivers for Uzbek cotton and Kazak grain. This is a contentious issue for Central Asia for a number of reasons: the divergence in the five countries economic policies and water needs; the decay of infrastructure (dams and monitoring), and irrigation systems and industry in the last decade; and the differing interests of upstream (hydropower) and downstream (irrigation) states. Thus, it is now necessary to establish multi-sector institutional arrangements at the regional, national, and local levels; to reinforce the Central Asian Economic Community; and to widely share data related to water use. Finally, a comprehensive regional strategy is needed that addresses the human, economic, environmental, political, and military dimensions.

Each of the Central Asian countries presented views on a variety of issues. There were many common concerns. Radioactive contamination from former Soviet storage areas threatens aquifers in the event of an earthquake or other natural phenomenon. There is also a common threat to dams and waste storage areas from terrorist activities. The Sarez Lake dam, for example, no longer meets safety requirements. If this dam breaks, a 70-meter high wave of water would move through the valley. The most urgent problem to this arid region is water. It is not only a matter of scarcity but quality as well.

Though there are diverging positions on some issues, there is a significant amount of regional cooperation. In large part, this is a result of common approaches and the organizational structure of these former Soviet states as well as recognizing that, to varying degrees, the countries are dependent upon each other. In Soviet times, natural disaster response was under Civil Defense. All Central Asian countries, therefore established Ministries of Emergency Situations using assets of Civil Defense. International support is required for Central Asian countries to generate progress in developing and funding long-term solutions that facilitate multilateral cooperation, promote sustainable development, and increase economic growth and quality of life. There was a universal acknowledgement that it is time to move beyond identification of problems to solving them.

MILITARY ROLE IN ENVIRONMENTAL SECURITY

The third Panel discussions had a national focus on the role of the military in Environmental Security (Chapter 4). It included presentations on Military Stewardship, Mitigating Environmental Damage, Turkish Earthquake Response, and Environmental Stewardship in the Philippines.

One of the major contributors to the level of earthquake damage experienced in Turkey was that there were no *effective* standards for building construction – the codes existed, but they were not followed. As a result of the disaster, newly enacted legislation regulates construction. Additionally, basic training for rescue specialists was nonexistent before the earthquake. Now Turkey trains for disaster response in its military engineering school.

The Philippine government recognized that its inattention to environmental issues was threatening the economy and driving the populace into the hands of the insurgency. The Philippine approach focused the military on environmental issues in its need to address the root causes of conflict. In that regard, the military doesn't have to address the root causes alone – local governments must help and that incentives for the people to make them shareholders in the solution need to be considered. In this situation, soldiers serve as catalysts to mobilize the community for environmental activity and thus build a stronger and more productive relationship with the population at large.

MILITARY RESPONSE AND SUPPORT TO CIVILIAN AUTHORITIES

The final Panel discussions had a national focus on military response and support to civilian authorities (Chapter 5). It included a discussion of Crisis Response in Latvia, a case study on Hurricane Mitch and disaster response planning, the Role of the U.S. National Guard, and Military Medical Support in Disaster Response. In leveraging the strengths of military, civil, and nongovernmental organizations countries can develop effective local, national, and regional responses in disaster situation. Throughout the region the most capable organization available to support the government's environmental security efforts is the military. In a support role to the civilian authority they have proven to be both effective first responders following a major disaster, and good stewards of the environment.

CRISIS MANAGEMENT EXERCISE

The Crisis Management Exercise (CMX) allowed participants to apply personal knowledge, professional training, and understanding of the region in a simulation that addressed the planning and execution of national and regional responses to an environmental crisis in the Central Asian region. During the CMX, participant role-players evaluated a major natural disaster that imposed significant infrastructure and environmental damage within the region. The three groups examined one of two scenarios: an earthquake in the Ferghana Valley; or an oil spill in the Caspian Sea. Acting as primary national and regional officials, each group identified civilian emergency planning processes and military support to civil authorities required to respond to the crisis. Responses to the fictional scenarios were developed within existing political, economic, and military frameworks, as well as the social landscape of the region. They were then presented to the plenary and used as a framework for discussions and recommendations.

CONCLUSIONS

After these discussions of the regional and national environmental challenges, conferees drew the following insights:

- Manmade or natural environmental problems are already causing tensions between the states of the greater Caspian basin and directly underpin regional stability.
- A nation's military priorities should include the protection of its people from environmental threats;
- Negotiation is the preferred option to resolve transnational environmental issues;
- Although most countries have some semblance of a disaster response infrastructure, multilateral regional cooperation is much more likely in a Caspian Sea environmental event than to a disaster in the land locked nations;
- Environmental remediation and sustainable development are more difficult to achieve in Central Asia than in the developed world.

THE ROAD AHEAD

Though there are diverging positions on some issues, there is a significant amount of regional cooperation and recognition of the importance of Environmental Security. Conference participants acknowledged that it is time to move beyond identification of problems to solving them. There is a need for international support for the Central Asia Republics to generate progress in developing and funding long-term solutions that facilitate multilateral cooperation, promote sustainable development, and increase economic growth and the quality of life.

The conference concluded with an outline proposed course for future engagement and cooperation. Rear Admiral Campbell, J5 USCENTCOM, proposed a two or three-day Senior Executive Workshop in 2002 as the next step. This workshop would be centered on formulating a multinational plan. Each country would be asked to bring their national plans and to be prepared to develop a regional plan on how to respond to disasters. This conference would include representatives from national ministries and agencies that are responsible for disaster response. Each would identify the relationships between these Ministries of Defense (MoD) and other relevant ministries and agencies. The conference would address preventive measures in addition to response. Additionally, the coordinators should consider conducting a multinational exercise or game to exercise the proposed/developed plan.

Environmental security will be USCENTCOM's primary option for assuring and engaging the Central Asian states and promoting multilateral cooperation. It provides opportunities for communication and cooperation between regional states that might in other ways be antagonists. Because the Central Asia states are young and politically risk adverse, engagement activities must be complementary to their short-term perspective and non-threatening to their national sovereignty. Disaster response as the environmental security engagement vehicle has proven valuable to meeting these requirements.

CHAPTER 1 - *Introduction*

Opening Remarks

Oberst Franz-Xaver Lauterer

Opening Remarks

Lieutenant General Michael P. Delong

Opening Remarks

Mr. Curtis Bowling

Intelligence Estimate

Mr. Clifford Fowler



OPENING REMARKS



By Oberst Franz-Xaver Lauterer



As the Director of the Conference Center at the George C. Marshall Center (GCMC) and on behalf of the Director of the George C. Marshall European Center for Security Studies, Dr. Robert Kennedy, I welcome you to Garmisch-Partenkirchen, the most thrilling part of Bavaria. Thank you for joining us this week to discuss the issues related to Environmental Security in the Central Asia and Caspian Basin.

The Marshall Center Staff and Faculty are extremely pleased to see such a broad representation of nations and non-governmental organizations for this event. Our goal is not only to analyze problems but also to stimulate dialogue that is necessary to achieve cooperative solutions. Therefore I'm especially grateful to our three co-sponsors, the United States Central Command, the United States Army War College, and the Office of the Secretary of Defense for undertaking the difficult organizational work of convening such a multiplicity of speakers and participants. I'm sure that we will all benefit greatly from this opportunity to learn from each other.

The aims and objectives that have been set by the four organizers of this conference are all within the core mission of the Marshall Center. They are to promote democracy, prosperity, and stability. These are aims that are inter-dependent, and looking to the region the theme of the conference is dealing with what needs to be addressed and worked nationally, trans-nationally, and regionally. Open discussions and participation by all attendants is important if the process is to be successful. Therefore we follow a policy of confidentiality and non-attribution in order to ensure anonymity. I ask that you challenge our speakers, the moderators, your colleagues, and yourselves with pointed questions and frank remarks.

Again I thank you all for coming. The Marshall Center is pleased to assist you in this endeavor and I hope that each of you find it a rewarding experience.

OPENING REMARKS

By Lieutenant General Michael P. Delong



Welcome to the first Central Asian States Environmental Security Conference with a military focus. This topic and the discussions we will have in the next few days are very important. I am very pleased to represent General Franks who, unfortunately, could not attend. He just returned from the U.S. Central Command Area of Operations and is testifying tomorrow before Congress concerning his plans for the future of the Central Command and our region.

This is the first time we've had a conference like this with the military and civilian organizations in the Central Asian states. While various other U.S. government agencies have worked with the Central Asian states before, we have not had the military representation that we have here today. Why is this important?

- The military in most countries can provide a significant presence. They have the number of people to handle emergency situations.
- The military can be great environmental stewards -- avoiding such behavior as dumping hazardous material and waste at sea or improper disposal on land.
- They also have the capability to plan for and rapidly respond to man-made and natural disasters.

We all think Environmental Security is a regional problem. It is not a single state problem since many of the significant environmental issues cross country borders. That is why we are here. All the participants from the Central Asian states, European community, the various U.S. government organizations, the United States Central Command, and our service components are here today for one reason: to talk about how we can deal with Environmental Security.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

Last year the United States Central Command sponsored an Environmental Security conference with our Gulf State partners. Some very important points came out of that conference. We explored such options as establishing inter-governmental environmental monitoring and warning centers, training on pollution prevention, and planning for environmental disaster relief actions as possible future engagement efforts.

We also discussed that there are some problems and mistakes to avoid regarding disaster responses. To properly manage and coordinate any relief activities you need to have the civil authorities matched with the right military authorities. It is already apparent that you recognize that concept as well since you have brought both civilian authorities and military representatives to this important conference. The matching of the civilian authorities and the military authorities is probably one of the most important things that will come out of this conference. Likewise, your country counterparts that match up with our Environmental Protection Agency and our Federal Emergency Management Agency personnel are critical to this initiative.

I would like for us to begin to work together. Before this conference perhaps you thought only of issues pertaining to your country. Now we are a regional organization. That is why we are here. While we are here representing our own countries concerns, we need to consider each other's country concerns right now, as we respond together, regionally, on different events that we will review during this conference.

As you can see from the agenda, we have some great guest speakers. The On Scene Commander will brief you on one of the largest environmental disasters that happened in our country, the Exxon-Valdez oil spill in Alaska. You will see how armed forces such as in the Philippines and the United States execute their environmental stewardship missions. There's more. There are a myriad of different environmental events that the different countries of the world have handled, or not handled, very well. We will look at several of them and learn from how they were managed.

These regional environmental challenges represent opportunities. I would like for us to work together for environmental cooperation. We, the Army War College, the Marshall Center, the United States Central Command, and the other U.S. Government

Responding to Environmental Challenges in Central Asia and the Caspian Basin

and international agencies represented would like to help you help each other to solve these important issues.

Again, I have no doubt that this conference will be a success. Getting your countries together in the same room, focused on the same, critically important issues is a success in itself.

I look forward to working with you and helping in any way possible during this next two and a half days.

OPENING REMARKS

By Mr. Curtis Bowling



On behalf of the United States Secretary of Defense, I would like to thank General Delong, the Marshall Center, and the Army War College for allowing us to be included in the co-sponsoring of this event.

Today I would like to give you a little history of the U.S. military's environmental program and talk a bit about our engagement efforts with other militaries around the world.

In the 1970s, the U.S. government began passing a number of environmental laws. The U.S. Department of Defense (DoD) was ill prepared to implement this legislation. The Department did not have the policies, programs, trained professionals, or budget required to meet the new environmental challenges. The result was a highly reactive environmental program.

In the 1980s, the U.S. military began developing our environmental program. We began training personnel and hiring environmental professionals. We started building environmental budgets. Our aim was to comply with environmental laws.

In the 1990s, building on the compliance oriented programs of the 1980s, DoD began to shift focus to pollution prevention – trying to eliminate the hazardous materials and waste from day to day operations of weapons systems. We started looking at ways to reduce life-cycle costs and to improve environmental performance.

In this decade, environmental focus has evolved to sustainment. How can we sustain our training activities – particularly when we look at competition for training lands, new, more aggressive environmental laws, and encroachment in and around our installations? The success of our programs to date have really been the result of the dedication of our military forces as well as the partnerships we have forged with interagency partners – such as the Environmental Protection Agency and the Department of

Responding to Environmental Challenges in Central Asia and the Caspian Basin

Interior – the agencies charged with enforcement of our environmental laws. These partnerships have been valuable to us in building a successful environmental program.

Today, the U.S. Defense Department has an environmental program that manages 10,000,000 hectares of land with an environmental budget that is about one and one-half percent of the total Defense Budget – creating a very formidable program. Let me now talk briefly about the history of U.S. engagement in environmental activities around the world.

Engagement began about 1980 with our NATO allies. With the conclusion of the Cold War, the program expanded to other militaries. Conferences such as this aided in expansion.

There are three things we have learned from these engagements. First, no matter which militaries we talk to, we are all facing the same environmental challenges. Second, we, the United States, do not have all the answers. The third thing we have learned is that cooperation can help us share lessons learned – the successes and the failures – and trust me, over the last 30 years the U.S. Department of Defense has had some failures. By sharing these failures, you might avoid similar paths and hopefully build more successful programs.

Collectively, our engagements have helped us and helped other militaries build strong environmental programs and improve environmental performance.

At the end of the Cold War, all the nations of the world began looking at national security in a different light: what are the emerging threats? Last night at the icebreaker, Dr. Kennedy talked about global threats, regional threats, and national threats. When we look at global threats, such as climate change, the floods in Mozambique, droughts, ozone depletion, biodiversity, they are all global challenges that in turn create regional and national challenges. These strains can tax resources and lead to conflict.

National challenges within a region can include such natural disasters as floods or earthquakes. Regional challenges also include accidents, such as the oil spill scenario to be discussed at this conference. And of course, at the national level, you all face specific, individual challenges.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

One of the things that you can take from this conference is that you don't have to go it alone. There are ways to leverage your resources: by working internationally, in conferences such as this; by working with non-governmental organizations, such as those represented here. Within a region, we have had some successful workshops where militaries have cooperated on regional challenges. In a national sense, working within your own borders, working with other agencies is very important – as I have said within the United States, such collaborations can help to achieve efficient and effective programs.

I would like to thank you for attending this workshop. I would like to meet with you either formally or informally, *perhaps in a more social setting*, to work on environmental issues.

INTELLIGENCE ESTIMATE

By Mr. Clifford Fowler

There is a different threat dimension gaining momentum and taking on greater importance in the Central Region and one that stands to ultimately solicit military involvement. The threat comes from environmental factors, which have security implications for the region.

The most notable environmental factor within the region and one that is having serious and lasting implications for security and stability is access to scarce, fresh water resources. Fresh water access is a major variable in regional political conflict and has the potential to escalate into military conflict. In Central Asia today water availability, access to fresh water, and in particular water quality are already exacerbating relations among neighbors.

For the foreseeable future, regional security will continue to be influenced by environmental factors. It is, in fact, plausible that the next war will be over water resources. I will submit, however, that environmental factors that threaten regional interests can also promote the region's shared interests of Stability, Conflict Resolution, Political strength, and Market Economies. A word of caution in this regard: on the surface the problems we are

talking about appear to be glacial in nature - however complacency, in this case, will be the enemy of preparedness.

In Central Asia, here is how Environmental Security stacks up in the macro view. We are increasingly concerned that the delicate balance of water resources can quickly become the object of conflict, particularly when combined with regional demand through population growth, agricultural development, and water diversion projects such as canals.

Scarcity aside, water quality has also been the impetus for political and economic instability. Degradation, pollution, and contamination threaten all riparian states depending on Central Asian water resources. Managing the supply and demand balance in order to meet economic requirements is a shared issue throughout the region.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

Other significant environmental security issues in Central Asia involve Caspian Sea energy development and physical changes, Aral Sea erosion, and uranium tailings contamination. The bottom line is that:

- Competition for limited resources will increase,
- Contamination and pollution are critical environmental issues,
- Stability of regional governments turns on meeting demands for resources and minimizing the impact of critical factors.

In order to understand the magnitude of the problem it is necessary to first put water in perspective. Of the accessible water on earth, 97 percent, is contained in the world's oceans. Only three



percent of the water on earth is fresh and of this, less than two percent is locked away in ice caps, glaciers, and aquifers. The remaining 0.36 percent is located in rivers, lakes, and streams. We are essentially talking about less than 1/2 of one percent of the earth's water being accessible fresh water.

A dominant characteristic of the available fresh water is its shared nature. Over 200 river basins are shared by at least two countries. As a single environmental issue, water has the most potential to become a source of competition, either as an independent object of war or in combination with other causes of regional hostilities. There are several environmental security issues in Central Asia, not the least of which are Caspian Sea energy resources and their impact on environmental health and subsequent security. In light of the economic development planned for and dominated by Caspian Sea initiatives, the environmental outlook is not favorable.

While future energy developments will be conducted under more stringent environmental controls and lead to a small environmental improvement, the long history of

contamination, combined with the short-term economic pressures to exploit the sea's potential, will mean that a threat to the Caspian environment will loom large. The danger of an oil development accident is always present.

Mitigating the environmental cost of energy development will be a significant challenge, particularly in health issues. Kazakhstan, for example, has noted cases of blood disease, tuberculosis, and other diseases that are four times more common in the Caspian Sea area than on average in Kazakhstan.

Other serious environmental concerns center on aging nuclear power plants such as the Aqtau Nuclear Power Station. The aging fast-breeder reactor poses a significant risk to the environment and a challenge to those responsible for waste or spill containment. As a liquid, sodium-cooled reactor it has unique safety concerns due to the highly combustible nature of the coolant and its high degree of contamination (200-300 times greater than normal). Naturally, the reactor's highly enriched uranium core cannot be ignored as another major risk factor. Additional safety concerns

are heightened by the reactor's proximity to the Caspian Sea (roughly 100m). Proposed decommissioning of the reactor will demand international and regional cooperation, as well as military and civil cooperation in addressing decontamination, drainage and treatment, sodium and highly enriched uranium removal. The Caspian Sea is perhaps one of the best examples of how the problems associated with a shared resource affect all riparian states.

The rapid rise of the Caspian Sea is also causing considerable environmental damage and economic loss in the low-lying coastal regions of all surrounding states. Since 1978, the Sea has risen more than seven feet, causing an estimated 30,000 km² to be flooded with heavily polluted water. This inundation has forced thousands of people to resettle and caused significant losses to capital investments of industry, infrastructure, and farmland.

In addition to the danger posed to the oil fields, especially in Azerbaijan and Kazakhstan, the rise in the sea's level has resulted in changes to biological communities, the hydro-chemical framework found in

Responding to Environmental Challenges in Central Asia and the Caspian Basin

the mouths of rivers, and the dynamics and chemical composition of groundwater and sediment deposition patterns.

Flooding of waste dumps, heavy metal storage sites, and agricultural lands laden with pesticides is also posing a serious water pollution problem. If the Caspian continues to rise, it could easily force Caspian Sea

maritime forces to either abandon some seaports or make expensive upgrades to them.

In the last 20 years, the Aral Sea has diminished considerably in surface area, over 100 km in some places and the base level of the sea has dropped 17 meters, threatening to further expose the former Soviet BW testing site, Vozrozhdeniya Island.



In 1988, the Aral Sea actually split in two – into a larger lake in the south and smaller one in the north. By the mid-1990s, the Aral Sea’s area had dropped by half and its volume by three-fourths. Vozrozhdeniya Island was used extensively for open-air testing of anthrax and other deadly airborne diseases. As part of the dismantling of Vozrozhdeniya Island, tons of anthrax were “decontaminated” and buried on the island. Vozrozhdeniya Island constitutes a significant environmental security concern for the region. The most immediate concern is the potential risk of live anthrax being transmitted into the ecosystem by airborne transport and infecting humans and animals. Additionally, each year, winds pick up millions of tons of toxic dust-salt mixture from the Aral’s dry seabed and dump them on the surrounding farmland, harming or killing the vegetation along with the cattle that eat the salt-poisoned crops.

Contaminated water and heavy pesticide use have contributed to poor sanitary conditions. Contaminated drinking water alone has contributed to rampant disease, including typhoid

fever, hepatitis, and esophageal cancer.

Home to a large percentage of the world’s uranium resources, the legacy of Central Asia’s uranium mining and processing is among the most significant shared environmental security threats to all five Central Asian states. Extraction of uranium from ore produces radioactive waste (uranium tailings) that is stored in piles and impounded in ponds. Though the radioactive waste is not a proliferation interest, it is a tremendous health concern. Levels of radioactivity can exceed 50-times the normal level and particles from the piles can be spread to area populations by the wind. Uranium tailing ponds pose a catastrophic risk throughout Central Asia. Similar to the Tisza River cyanide spill that followed a tailings pond burst in Baia



Mare, Romania in January 2000, a breach of similar dams in the region is both a near-term and long-term threat to human health throughout Central Asia. Precariously poised on trans-boundary water resources, such as the Syd Darya and Amu Darya Rivers, these resources are vulnerable to strong earthquakes. Even an unusually heavy rain could cause the weak tailings pond dams to fail and a catastrophic discharge of radioactive sludge into nearby rivers. A short-term threat exists here. Several tailing ponds, located along the banks of the Syr Darya River or its tributaries, could wipe out a way of life that has thrived here for millenniums and threaten the lives and livelihood of millions. The long-term threat posed by uranium tailings is that posed by radioactive contaminated liquids seeping into underground water resources such as area aquifers and the migration of this contaminated water to urban, high use areas.

These and other environmental factors will influence security in the region for the foreseeable future. Water quantity and quality issues will continue to dominate the relations between regional neighbors. The shared

nature of the region's limited water resources also poses one of the most common concerns for regional stability in the future. Fair and equitable distribution of ample and clean water, which is viewed by all states as a sovereign right, will see challenges as states seek to balance supplies against rapidly rising demand.

Finally, upstream agriculture-driven economies will be faced with balancing production requirements against downstream user requirements for fresh water not contaminated by agricultural chemicals. The role of the intelligence community in responding to environmental security issues will likely come in various forms. Utilizing the IC's unique information gathering infrastructure may be critical. Understanding the environmental threat and how it can contribute to conflict and instability, and providing adequate warning of potential environmental crises will be at the heart of intelligence support to environmental security. One challenge is to understand where and under what circumstances environmental degradation and scarcity may contribute to instability and conflict, and to address those

Responding to Environmental Challenges in Central Asia and the Caspian Basin

conditions early enough to make a difference.

For the foreseeable future, I will submit that the form of state competition is in fact changing. It is no longer dominated by territorial expansion and the defense of national borders. Rather, economic power, increasing gross national product (GNP), and access to natural resources are increasingly driving state competition. Suffice it to say that environmental issues will dominate the landscape as a potential destabilizing geopolitical factor in the 21st Century.



Responding to Environmental Challenges in Central Asia and the Caspian Basin

CHAPTER 2 - *Global Focus: Defining the Issues*

Panel Moderated by Dr. Kent Hughes Butts

Defining Environmental Security

Dr. Kent Hughes Butts

Learning from the Valdez Oil Spill

Vice Admiral Clyde Robbins, USCG (Retired)

Mozambique Floods

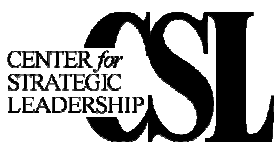
Mr. L.J. Buys



Responding to Environmental Challenges in Central Asia and the Caspian Basin

DEFINING ENVIRONMENTAL SECURITY

The Environment: A National Security Imperative



by Dr. Kent Hughes Butts, Ph.D. and LTC Edward L. Hughes

In the last decade we have seen a major shift in the national security issues faced by the United States (U.S.) and the emergence of regional instability as the chief threat to U.S. security interests. Research found that environmental issues such as competition for scarce resources (water, oil), or droughts that cause millions to migrate, destabilize regions and threaten U.S. national security. In recognition of this, the National Security Strategy (NSS) of the United States, which is issued annually by the President, recognizes environmental security issues as threats to U.S. interests and potential triggers of political conflict. However, the NSSs have also recognized that the transnational nature of many environmental problems requires multilateral cooperation for their resolution, making them valuable instruments for regional confidence building.

OVERVIEW

As a result, the U.S. Regional Warfighting Commanders-In-Chief (CINCs) now have Theater Engagement Plans (TEPs) that include at least a draft Environmental Security Annex. In fact all four of the CINCs have used elements of Environmental Security to promote cooperation and communication among regional states. They are not alone. In 1999 the Department of Defense (DoD) and the Department of State (DoS) held an India Environmental Security Workshop in an effort to identify a U.S. inter-agency

approach toward common environmental issues on which India and the U.S. might cooperate under the current restrictions. In February 2001, a People's Republic of China (PRC), People's Liberation Army (PLA) delegation toured the United States, engaging with military officials on commonly shared environmental issues. One of the few areas where the Pacific Command (PACOM) has engagement activities with the PRC is in the area of environmental security, with a Disaster Response tabletop exercise planned for October 2001.

Environmental security issues are actually just political geography issues. However, like using the term Weapons of Mass Destruction (WMD) when one correctly means Nuclear, Biological and Chemical (NBC), Environmental Security has become fashionable and is a major international affairs variable of U.S. foreign policy and statecraft. The State Department has an Environmental Diplomacy program that uses regional environmental issues to promote U.S. diplomatic initiatives. The Central Intelligence Agency (CIA) created a new Environmental Center to inform policy makers and the Regional CINCs on the environmental issues that are causing or will cause conflict in their regions. The Department

Environmental Security deals with the quality and quantity of resources necessary to sustain the country's security interests.

of Defense reorganized its Environmental Division into the Deputy Under Secretary of Defense for Environmental Security. Thus Environmental Security has become a vehicle for U.S. engagement activities. What then do we mean by the term Environmental Security; what are the key issues; and what is the appropriate military role?

INTRODUCTION

The world in which a country exists is its environment. That



environment nurtures and sustains the populace of that country. There must be a balance between the needs of the people and the environmental resources necessary to meet those needs and maintain the country's cultural integrity and vitality. If it is to maintain its legitimacy, the political system of a country must be able to meet the demands placed upon it by its people; thus environmental security is a significant variable in governmental tenure. The economy, health, welfare, and culture of a country depend on resource quantity and quality. Maintaining the physical resource base (clean water, energy, fertile soil, healthy air) of a country is a major governmental priority and requires all of the elements of national power. Increasingly the military element of power is seen as appropriate to support a country's environmental security. Whether it is protecting the sea lines of communication (SLOCs) necessary for oil or industrial resource imports, or managing the consequences of a natural or man-made disaster, the military has a rich history of environmental security missions. In the wake of the Cold War, the militaries of the newly independent states have found environmental security missions to be useful to the country and for promoting regional military cooperation and international engagement.

Environmental Security is a valuable national security concept, yet it is often marginalized, because it is misunderstood. Environmental Security deals with the quality and quantity of resources necessary to sustain the country's security interests. Pollution, which many identify as the focus of Environmental Security is relevant because it reduces the resource base available to meet the needs of a state's population. Similarly, natural and manmade disasters, soil erosion, over-fishing, and nuclear issues may affect resource availability. More traditional security threats occur when other actors threaten to limit the country's ability to import resources or over-consume what they consider to be their fair share of commonly held resources. Oil

President George Bush recognized that failure to responsibly manage natural resources was already producing stress that was contributing to political conflict.

supply disruption, the upstream damming or diversion of rivers, illegal timber harvesting, and fishing within another country's territorial waters exemplify the phenomenon. Countries will normally act to protect their resource base. Therefore, Environmental Security may

contribute to one's understanding of state behavior, has significant implications for state and regional stability, and constitutes a valuable role for the military.

The definition of national security changed with the end of the Cold War and was broadened to include the environment. In 1991 the environment was included in the United States National Security Strategy (NSS).¹ In that document, President George Bush recognized that failure to responsibly manage natural resources was already producing stress that was contributing to political conflict. The demise of the Cold War changed the nature of regional stability; as many regional states became free from the influence of superpowers they became more vulnerable to long-standing religious, ethnic, or political enmities. The resulting tensions threatened regional stability and U.S. interests, and challenged the U.S. and the military CINCs to offer a strategy of engagement on issues that transcend these challenges. Environmental Security is just such an issue.

In recent years there has been a growing interest in the impact of environmental change on

national security. Nevertheless, controversy exists concerning the term environmental security. Much of the current literature on Environmental Security criticizes the term either because it undermines the traditional view that national security refers primarily to military threats against a nation, or because it is rooted in the nation-state paradigm and fails to seek solutions at the global security level. United States interests, and those of most countries, turn on *regional stability*. Environmental issues, such as resource access and quality, are now recognized as a major variable in regional stability and conflict, exacerbating tensions resulting from religious, ethnic, and other local differences such as socio-economic disparities between rural and urban areas, rapid economic development, and border disputes. However environmental issues may also be leveraged to promote regional stability as confidence building measures, creating opportunities for communication and cooperation between regional states that might in all other ways be antagonists. In this context, Environmental Security offers a viable new option for U.S. preventive diplomacy and CINC engagement strategies. Because the military is one of the key elements of national power traditionally used to address security issues, it is appropriate that the military

¹ National Security Strategy of the United States, Washington, DC: U.S. Government Printing Office, August 1991.

address the current threats posed to national security by environmental change.

There are literally scores of environmental issues related to conflict. The U.S. Central Command (CENTCOM) has long recognized fresh water quality and access as a regional issue that can contribute to conflict and which merits dialogue.

Just ten years ago, a substantial coalition of forces led by CENTCOM fought a major land, air, and sea campaign over energy resources. Today Infectious disease is expected to explode within an ever-burgeoning population with new and resurgent diseases that confound medical technology. It is these three areas of Environmental Security – water, energy, and infectious disease – that provide growing concern on a global scale.

THE SECURITY MILIEU

Today's security environment is arguably less stable and predictable than that of the Cold War era. Previously constrained national, ideological, ethnic, and religious variables now create regional instability that threatens U.S. and global security interests. This regional instability has supplanted the Soviet military threat as the dominant threat to world peace. Many regions of the developing world have artificial political borders imposed upon them by agreements largely designed

and implemented by outside powers. Local dissatisfaction with these borders, long suppressed by forced client status and super-power influence during the Cold War, has already led to conflict involving U.S. forces. Borders that divide national groups give rise to ethnic tensions that complicate the efforts of any government, totalitarian or democratic, to maintain its legitimacy. The spread of democracy to these countries forfeits oppressive government options for controlling popular discontent and amplifies the possibility of governmental change.

These regional tensions are often exacerbated by a scarcity of natural resources: water, arable land, energy, and fuel. The insufficient quantity and poor quality of these resources are often caused by ecological degradation resulting from failed agricultural and economic policies. The demands on indigenous social structures and the political systems of these governments will become worse with the increased demands of a burgeoning world population, expected to escalate from approximately 6 billion today to an estimated 8 billion by the year 2025. This complex interaction of variables, coupled with uncontrolled population growth, is providing the conditions necessary for the spread of infectious disease.



Water

Research on conflict generally recognizes that a single variable cannot be identified as the cause of conflict; multiple contributing variables usually exist. Nevertheless, environmental issues may serve as a trigger for conflict when tensions already exist. In this regard, fresh water is undeniably an important variable. Water is an essential resource for which there are no substitutes. Most of the water on the earth, some 97 percent, is contained in the world's oceans and is therefore of little use for essential agriculture, drinking, or most industrial uses. Only three percent of the water on the earth is fresh and, of this, more than two percent is locked away in the polar ice caps, glaciers, or deep

groundwater aquifers, and is therefore unavailable to satisfy the needs of man.²

The fact that water does not lend itself to international trade complicates the water resource scarcity problem. Unlike metals, grain, timber, coal, or petroleum, water cannot be transported economically in large quantities, certainly not in the quantities necessary to satisfy the demands of even a small country.

While there are schemes to divert major rivers, create long canals, tow icebergs, or desalinate water, such schemes have substantial economic and political costs. They appear to be sustainable solutions to

² Peter H. Gleick, ed., Water in Crisis: A Guide to the World's Fresh Water Resources. New York: Oxford Univ Press. 1993. p. 3.

water scarcity problems only in rare situations.³ The supply of fresh water is limited by the hydrologic cycle and general climatic conditions, and demand for water as an agricultural, industrial, or urban resource is increasing exponentially with the rising global population. More important, from both historical and practical perspectives, are the countries that share access to major rivers. Decisions by upstream countries to develop common water resources, however, can have major implications for the economic viability and continued cultural existence of those downstream. Water passed to downstream users, even in water-rich regions, is often contaminated by toxic and hazardous wastes, pesticides, and fertilizer; its use may also be limited by increased salinity due to multiple iterations of irrigation.

Given the fact of exponential population growth, changes in climatic conditions, and the imbalance of resource supply and demand, water will continue as a source of tensions; it could become the determinant variable in future international conflict.

Governments will face increased pressures to ensure their people

³ Guy Hoberson, "Oil Firms get into Iceberg-Moving Business," The Christian Science Monitor, 3 Nov. 1976, p. 1.

have access to fresh, clean water. In arid areas where population growth occurs, irrigation usually accounts for increases in food production, which creates new problems of subsidence from over-pumped aquifers (China), water pollution from fertilizers and pesticides, and international tensions over control of rivers and aquifers.

Energy

A particularly important resource in the environmental security equation is energy. A major input to the economy of all states, energy resources are unevenly distributed, creating an imbalance of supply and demand that challenges the foreign policy of governments and defines many environmental security missions for the military. Militaries regularly provide security to energy corridors, both domestically and cross-border. This often promotes multilateral cooperation to protect SLOCs and pipelines. Nuclear power plants have considerable disaster potential. Preparing for and responding to national catastrophes, challenges military planners and constitutes an indispensable military support to civil authority. Occasionally, the development of energy projects, such as large-scale hydroelectric schemes, creates tensions with military dimensions for which the



defense sector must be prepared to respond. The military roles are relevant to developing as well as developed economies.

Energy is vital to the economy of the United States. The U.S. has been self-sufficient in energy for most of its history. In the 1960s, however, consumption began to out-pace domestic production capacity. Although the efficiency with which Americans use energy has improved over the years, by 1999 approximately 25% of U.S. energy needs had to be met by imports. More to the point, over half of U.S. petroleum supply was imported.⁴

⁴ U.S. Department of Energy, [Energy in the United States: A Brief History and Current Trends](http://www.eia.doe.gov/emeu/aer/eh1999.html), retrieved 21 Feb, 2001, from <http://www.eia.doe.gov/emeu/aer/eh1999.html>.

The sources that feed this energy need in the United States include non-hydro-electric renewable energy, hydro-electric power, and nuclear electric power (14 percent); coal (22 percent); natural gas (22 percent); and the largest source - petroleum (42 percent).⁵ The first three categories are largely domestically produced or harnessed sources of electric power. The United States is a net exporter of coal and 90 percent of its natural gas needs are met with domestic sources.

It could be argued that the North America electric power grid, nearly half of which is

⁵ History: Energy Information Administration. [Annual Energy Review 1999](#), Table 1.3., and Projections: Energy Information Administration, [Annual Energy Outlook 2000](#), Tables A1 and A18.

generated by coal, is vulnerable to interruption. The railroad system that delivers coal to 40 percent of power generation plants is aging. Additionally, the power generation infrastructure itself is old and has a limited capacity to respond to future needs (estimates are through 2005).⁶ This has recently been demonstrated in blackout and brownouts throughout both the Western and Eastern Interconnections of the North American Power Grid. Although disruptions along the grid are felt immediately, this vulnerability is well inside our domestic span of control with which to plan and mitigate. The energy infrastructure of a country is critical to the national economy, a significant target for terrorist groups, and easily disrupted by natural or manmade disasters. The military is usually involved in protecting elements of this infrastructure as well as dealing with the social implications of supply disruptions.

Petroleum

Although the impact of disruptions in the flow of oil is normally not immediate, it is

petroleum that provides the greatest vulnerability to the U.S. economy, especially considering that the transportation and industrial sectors of the economy account for over 90 percent of the petroleum consumption in the United States. Until the 1950s, the United States produced nearly all of the petroleum it needed – after 1992, imports exceeded production in order to meet growing consumption. The five leading suppliers of petroleum to the United States in 1999 were Saudi Arabia, Venezuela, Canada, Mexico, and Nigeria.⁷ From a national security perspective, the United States relies on a diverse and growing number of suppliers to mitigate vulnerability to interruptions in the flow of petroleum.

In order to further mitigate this threat, the United States created the Strategic Petroleum Reserve (SPR). The SPR is an emergency supply of crude oil stored along the coastline of the Gulf of Mexico. Decisions to withdraw crude oil from the SPR during an energy emergency are made by the President, under the authorities of the Energy Policy and Conservation Act. In the event of an energy emergency, SPR oil would be distributed by

⁶ United States of America Nuclear Regulatory Commission, Transcript: Briefing on Electric Grid Reliability, Public Meeting, Rockville, MD, April 23, 1997. Retrieved February 21, 2001 from <http://www.nrc.gov/NRC/COMMISSION/TRANSCRIPTS/19970423b.html>.

⁷ U.S. Department of Energy, Energy in the United States: A Brief History and Current Trends, retrieved 21 Feb, 2001, from <http://www.eia.doe.gov/emeu/aer/eh1999.html>, pp. 12-16.



competitive sale. The SPR's current size (nearly 570 million barrels) and the U.S. government's stated policy to withdraw oil early in a potential supply emergency make the SPR a significant deterrent to oil import cutoffs and a key tool of foreign policy.⁸

In 1997, U.S. petroleum demand was over 18.6 million barrels per day and is expected to grow to 24.7 million barrels per day by 2020 while estimates of proved world crude oil reserves vary between 974 and 1,020 billion barrels.⁹ Without

any major field discoveries, the United States alone could consume the entire world's proved reserves within the next 100 to 150 years. At 1998 consumption rates (73.643 Million Barrels/day), the world could deplete these reserves in as little as 40 years.

Fortunately, due largely to technological developments, the world's proved reserves have grown commensurate with consumption. Regardless, because over two-thirds of the world's remaining proved petroleum reserves¹⁰ are located

⁸ US Department of Energy, Strategic Petroleum Reserve: America's Energy Insurance, retrieved February 21, 2001, from <http://www.fe.doe.gov/spr>.

⁹ U.S. Department of Energy, Energy in the United States: A Brief History and

Current Trends, retrieved 21 Feb, 2001, from <http://www.eia.doe.gov/emeu/aer/eh1999.html>, pp.3,5,13.

¹⁰ Proved Reserves of Crude Oil is defined as the estimated quantity of all liquids defined as crude oil, which

in the Middle East, this region's stability is strategically crucial not only for the U.S., but for the continued growth of all developed and developing national economies. Governments will face continuing pressures to ensure their globally interconnected economies have access to petroleum and its refined products. Militaries will remain an important element to guarantee uninterrupted flow, protection of petroleum Industrial infrastructure, and responding to disasters and the social implications of supply disruptions.



geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

Infectious Disease

The link between infectious disease and inter- or intra-state conflict is neither obvious nor direct. Contagion is one among a complex array of inter-dependent variables that contribute to the potential for regional conflict. The Chemical and Biological Arms Control Institute and the Center for Strategic and International Studies (CSIS) International Security Program identified in a January 2000 report that globalization, population changes, and environmental degradation were the critical factors contributing to a growth in the world's vulnerability to infectious disease.¹¹

Globalization has made national borders much more permeable – not necessarily with regard to inter-state incursions, but certainly with regard to infectious disease. Increased passenger travel and more expansive trade in both agricultural products and animal products are sources for introducing new contagion.¹² Exploding populations increase

¹¹ William J. Taylor, Jr. and Michael Moodie, Contagion and Conflict: Health as a Global Security Challenge, A Report of the Chemical and Biological Arms Control Institute and the CSIS International Security Program, January 2000, p. 3.

¹² *Ibid.*, pp. 3-4.

competition for scarce basic resources and increase poverty, the greatest cause of political instability. Suffering populations migrate, thus contributing to the spread of disease, and often overpowering the capacity of urban housing and sanitation.¹³ With the global population heading toward 8 billion, and most of the increase being in the fragile developing states, this problem will only worsen.

Desertification from over planting and overgrazing, deforestation from shortsighted and irresponsible agricultural practices, and reduced access to fresh water resources are forms of environmental conditions that contribute to the spread of infectious disease.¹⁴ Similarly, a special report by the U.S. National Intelligence Council found that “the resurgence of the infectious disease threat is due as much to dramatic changes in human behavior and broader social, economic, and technological developments as to mutations in pathogens” and lists a number of contributing factors.¹⁵

- *Human Demographics and Behavior*

- *Technology and Industry*
- *Economic Development and Land Use*
- *International Travel and Commerce*
- *Microbial Adaptation and Change*
- *Breakdown of Public Health Measures*
- *Climate Change*

Given this growing vulnerability to infectious disease, security challenges can manifest themselves in a number of ways. These range from the inadvertent consequences of an inability to deal with the aforementioned conditions on one end of the spectrum, to a deliberate act to induce contagion to an unsuspecting populace on the other end. The CSIS report highlights “three intersections” of health and security:

- *Loss in a Government's Legitimacy.* Countries unable to provide public infrastructure (garbage, water, sewage facilities), basic health services, and safe (nontoxic) environments, are at greater risk of collapse.¹⁶
- *Intentional Manipulation of Relief Efforts.* Manipulating

¹³ *Ibid.*, pp. 6-8.

¹⁴ *Ibid.*, p. 9.

¹⁵ National Intelligence Council. “The Global Infectious Disease Threat and Its Implications for the United States,” Environmental Change and Security Project Report: Issue 6, Woodrow Wilson Nenter, Summer 2000, pp. 44-46.

¹⁶ William J. Taylor, Jr. and Michael Moodie, Contagion and Conflict: Health as a Global Security Challenge, A Report of the Chemical and Biological Arms Control Institute and the CSIS International Security Program, January 2000., p. 10.

food supplies and medicine “is an increasing trend in civil conflicts for combatants”.¹⁷

Where there is legitimacy in government, there is no appeal to insurgency. Conversely, a lack of legitimacy, perceived or real, is a recipe for instability and conflict.

- *Proliferation of Biological Weapons Capability.* Dual use technologies make this capability nearly impossible to track and control on a global scale.¹⁸ The threat here exists in terms of accidental contamination and infection, intentional use by capable nation-states, and terrorist attack.

Governments will be compelled to implement measures to reduce their populations' vulnerability to infectious disease. Militaries will have an important role in supporting civil authority by participating in programs to reduce or eliminate some of the environmental conditions that lead directly to the spread of infectious disease, managing uncontrolled population migration, and responding to enforce necessary controls in containing and mitigating the effects of epidemics.

¹⁷ *Ibid.*, p. 11.

¹⁸ *Ibid.*, p. 11.

STRATEGY FOR A SECURE NATION

Nation states require a national security strategy in order to function in an uncertain global milieu. This strategy should define national interests, the objectives necessary to achieve those interests, and the means or elements of national power with which they are to be pursued. In the U.S., the 1986 Goldwater-Nichols Department of Defense Reorganization Act amended the National Security Act of 1947 to ensure just such a strategy. As required by Goldwater-Nichols, the President transmits to the Congress a comprehensive annual report that defines the U.S. national security strategy, as well as the global interests, goals, and objectives vital to U.S. security (DOD Reorganization Act 1986).¹⁹ Also required are proposed short and long-term uses of the various elements of national power (political, economic, military) necessary to protect or further U.S. interests and achieve stated objectives.²⁰ The NSS document is intended to be a

¹⁹ Section 108 [50 USC 404a](a)(1). National Security Act of 1947, as amended by Public Law 99-433. Department of Defense Reorganization Act of 1986, 1 October 1986. Section 104 (b)(3&4). (Goldwater/ Nichols).

²⁰ David Jablonsky, [Time's Cycle and National Military Strategy: The Case for Continuity in a Time of Change](#). Carlisle, PA: Strategic Studies Institute, U.S. Army War College. 1995.

clear articulation of the elements necessary to ensure the survival of vital U.S. interests, and a strategic vision that allows other nations to understand U.S. priorities.

During the Cold War, the National Security Strategy documents reflected the primacy of the military threat from the Soviet Union. With the end of the Cold War however, the National Security Strategies changed to reflect the waning of the strategic nuclear threat and the ascendance of regional, economic, democratic and environmental threats to U.S. interests. Thus, in the 1991 NSS, the focus of U.S. military capabilities became regional conflict, America's economy was recognized as a vital interest, and environmental issues were given credit for being a source of conflict that threatened U.S. interests (NSS 1991).²¹ All subsequent National Security Strategy documents have included environmental issues for their importance to U.S. national interests. Debates that suggest that security studies and the term national security should only be applied to military threats fail to recognize the transition from a military dominant threat to one of a regional, economic, social, and environmental nature, and the

need for proactive military involvement to prevent conflict and create the conditions for peace.

The United States has not been alone in recognizing the change in threat to core security interests and the importance of environmental issues. In November 1991, for example, the North Atlantic Treaty Organization (NATO) modified its Strategic Concept and elevated economic, social, ethnic, and environmental problems to major importance as significant new threats to Alliance security. This change reflected in part the threats to European security posed by environmental problems in the former East Bloc, Middle East and Africa. As a result, NATO's missions were changed to include mitigating environmental problems that threaten democracy and political stability (NATO 1991).²² Given that the leadership of the European Community and the United States has recognized environmental threats to their current security interests and is willing to dedicate the various elements of power to addressing these issues, it is time to move beyond the academic debates and address how best to solve these problems.

²¹ National Security Strategy of the United States, Washington, DC: U.S. Government Printing Office, August 1991.

²² NATO, "The Alliance's New Strategic Concept," November 7, 1991, NATO Press Service, Pres Communiqué S-1 (91) 85, p. 3.

While environmental degradation may be an indirect threat to the national security interests of developed countries, through its role in regional stability, for developing countries with nascent independent or democratic regimes it may constitute a direct and significant threat to state survival. Burgeoning populations outstep the formal economy and add to poverty, which forces people to consume renewable resources at a non-renewable rate. This wasteful consumption of resources erodes an already limited resource base, setting the stage for failed states. Resource management typically falls to smaller under-staffed environmental or natural resource ministries that lack the transportation, communications, and manpower resources required to enforce sustainable development practices. In such situations, the military element of power may be the optimum resource with which the government may seek to sustain its resource base.

Though fresh water access, energy resources, and the spread of infectious disease are all Environmental Security issues of growing concern throughout the world, in isolation they can often be extremely contentious topics. Conversely, disaster response – and the necessary military support to civil authority – provides an effective backdrop

upon which nations and their militaries can constructively engage.

MILITARY ELEMENT OF POWER

Many reasons argue against using military power to address environmental security problems. First, many domestic and foreign military leaders are reluctant to assume non-military roles and missions out of concern for sacrificing operational readiness. Moreover, performing "non-military" missions runs counter to the military culture, which may see its primary function as using military force to defend national interests from military threats. In a different vein, many environmentalists whose support is critical to a military contribution to the environment, have an antipathy for the military, or believe that it represents a state-centric solution when global approaches are more appropriate. And of course, the military has despoiled the environment, through training, combat and more significantly, by producing weapon systems – estimates of U.S. defense sector environmental cleanup costs reach hundreds of billions of dollars. Further, in many countries during the Cold War era, militaries were used to oppress domestic internal dissent, which were sometimes environmental in nature.



While there are tradeoffs and risks, it is nevertheless difficult to name any organization with a greater capability to address domestic and international environmental problems than the Department of Defense. With a budget of \$265 billion, even a reduced environmental posture in the U.S. Department of Defense provides important resources that may be dedicated to environmental improvement. As Congress demonstrated with the Soviet Nuclear Threat Reduction Act (Nunn-Lugar), the military has unique capabilities that allow it to predict, plan for and attend to environmental security problems. Also, in many countries the military is a substantial asset that address, or could be used to address, critical environmental problems for which few, if any, monetary

resources exist. Functionally and institutionally, it is well suited for the task.

Although using the military in environmental arenas is sometimes deemed inappropriate because of its requirement for secrecy and intelligence capabilities, these very attributes have been quite valuable in solving global and environmental problems. The scientific community has benefited from the Administration's decision to provide scientists studying diverse and important global issues, such as climatic change, oceanography, and marine and fish stock management, with information from the Naval Oceanographic Data Distribution System (NODDS) and data from the undersea Sound Surveillance System (SOSUS). DoD intelligence assets have

also been directed against illegal fishing. To support the moratorium on large-scale drift net fishing, U.S. aircraft, satellites, and ships have been used to detect illegal fishing and provide this data to those responsible for enforcement (Center 1995).²³ Intelligence assets have also played an important role in Non Governmental Organizations' (NGOs) successful efforts to bring food and water to famine and war victims and refugees in Somalia and Rwanda. It is possible to achieve even greater use of DoD intelligence assets for the good of the environment, such as providing data for an environmental crisis monitoring system (in conjunction with other elements of the intelligence community) designed to provide policy makers with early warning of threats to the environment.

The logistical, technical, and industrial resources of the Department of Defense are vast and have substantial international applicability. The technology and organizational skills inherent in these functional areas have been brought to bear with great effectiveness on international environmental problems. At Norway's request, DOD has entered into a tri-

lateral arrangement with Russia and Norway to address Russian nuclear waste management in the Arctic seas. Because of DoD's extensive installation and industrial plant ownership, it has developed management expertise that translates easily to overseas urban and Industrial site cleanup and management. Thus DoD can offer training and assessment on such critical environmental functions as remediation planning, threat management, water resource management, environmental measurement and assessment, management training, environmental education, organizational planning, base restoration, geographic information systems, economic and environmental infrastructure design, planning, and construction, as well as the ability to provide disaster relief. This is particularly important to former Soviet states that struggle to deal with the toxic and hazardous waste from Soviet military weapons, equipment, and test sites.

These skills and capabilities are transferable to developing countries and countries with severe environmental problems through the already existing Military-to-Military Contact Program and the Security Assistance Program. Under the first program DoD has established military-to-military contacts throughout East and

²³ William Center. "Military and the Environment." Presentation by Admiral Center to the Woodrow Wilson Center Environment and Security Discussion Group. 1995.

Central Europe. Specifically, DOD has sent teams to Estonia and Lithuania to help restore former Russian military bases. This program's managers indicate that in these countries the greatest single need for environmental assistance is the common environmental testing methodology of the Department of Defense (Carson 1994).²⁴ Providing DoD's environmental assessment technology, technical procedures and management skills through the Military-to-Military Program helps resolve environmental problems and allows struggling democratic regimes to develop economic resources from former military sites. Such visits also promote goodwill and understanding between former antagonists and may contribute to Partnership for Peace initiatives and multilateral regional cooperation when environmental problems are common to several countries or are trans-boundary in nature.

The most comprehensive method to apply DoD resources to regional environmental security objectives is through the joint State Department/DoD Security Assistance Program. In cooperation with the Unified Commanders (CINCS), who have regional responsibilities, Ambassadors, the State

Department, U.S. Agency for International Development (USAID), other donor countries and the private sector, this interagency program has been effective in addressing environmental programs, particularly in Africa, where poverty, the chief cause of political instability, is a chronic and widespread phenomenon. Under this program, the U.S. military has been assisting African countries to promote sustainable development and maintain their natural resource base. Nearly 20 countries received military assistance for the diverse environmental activities of fisheries management, game park preservation, wildlife management, anti-poaching programs, water resource management and conservation activities. In addition to providing timely assistance for such current environmental problems as the inability of African littoral states to protect their coastal waters from over-fishing by foreign flag trawlers, the program assists the host government military to develop environmental crisis management capabilities and to become a resource that governments may use to address future environmental problems.

CONCLUSION

The potential for further regional conflicts looms large. It is a far less expensive and a more sound policy to actively

²⁴ William J. Carson. "Environmental Security in the U.S. EUCOM Area of Responsibility" (BACKGROUND PAPER). March 9, 1994.

engage in programs that address the underlying causes of regional tensions, than to send forces to prevent conflicts. The environment will continue to have a significant role in international stability and should, therefore, be seriously addressed by U.S. national security policy. As a key executor of this policy, DoD has capabilities that should be used in resolving the environmental challenges that the United States must face. Through effective leadership, partnership, and resources, U.S. federal agencies can serve as an environmental security magnet effectively bringing together the international community to mitigate issues that could lead to instability

and conflict, promote sustainable economic development and preserve our planet. Moreover, Environmental Security may be a powerful confidence building measure that promotes multilateral communication and cooperation and builds bridges between antagonistic states. The CINC Engagement Program, the National Guard State Partnership Program, the U.S. Department of State (DoS) Environmental Hubs, the U.S. Environmental Protection Agency's (EPA) International Activities Office, and the Office of Foreign Disaster Response are but some of the U.S. entities that are successfully promoting environmental engagement.

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LEARNING FROM THE EXXON VALDEZ CRISIS



By Vice Admiral Clyde Robbins, USCG (Retired)

When the 987-foot tanker Exxon Valdez ran aground shortly after midnight March 24, 1989, over ten million gallons of crude oil entered the pristine waters of Prince William Sound, Alaska. The spill spread over 3000 square miles and onto some 350 miles of shoreline. Despite earlier requirements for quick and decisive action response teams from the oil terminal at Valdez, Alaska, response was slow and insufficient. Uncontained, the oil moved rapidly into areas previously untouched by pollution. Pictures of oil covered birds and sea otters quickly found their way into every newspaper and every television, worldwide.

How did the United States find itself in such a situation? Having developed an aggressive pollution program in the early seventies, it seemed impossible that the United States would have allowed this major ecosystem disaster to occur in the late eighties. Occur it did.

Let us examine the facts. Valdez Alaska is home for a terminal for the Alaskan pipeline where ships load millions of gallons of crude oil destined for the lower 48 states each day. When the pipeline was built, authorization for the construction included a requirement that the terminal operator maintain pollution control teams. That was done but through the years, from lack



Oil was lightered (transferred) from the Exxon Valdez (left) to the Exxon Baton Rouge (right), in a successful effort to keep the oil remaining on the Exxon Valdez from spilling into Prince William Sound. About one-fifth of the oil carried by the Exxon Valdez was spilled; the remaining 42 million gallons of oil was safely transferred to the Baton Rouge.

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of use and concern, those teams had become smaller and smaller. Pollution control boats and barges had deteriorated to the point they were near useless. Crews were assigned to other tasks and were poorly organized.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

The response teams simply were not ready when a spill occurred some 25 miles from the center of population.

In addition to the response organization, the authorization included a requirement for a traffic management system, which included designated traffic lanes with shore based radar to monitor the movement of ships through the system. It was in my opinion only marginally effective. Never given the assets or the authority to *control* traffic, it was ill prepared to watch and warn the Exxon Valdez that she was out of the traffic lane and headed for Bligh Reef.



Despite the foregoing, it was the ship's crew that had the ultimate responsibility for the gigantic spill that broke all records in the U.S. for oil spills. Having asked for permission from the Coast Guard personnel manning the traffic center to

move into the up-bound traffic lane to avoid ice flows, it was the Exxon Valdez's crew's responsibility to ensure the ship stayed within the confines of that lane. This, because of confusion on the bridge, they did not do. Within minutes, the ship had aground and spilling its contents into the Sound.

The immediate reaction of the ship's captain was to free the ship. Having ripped the ship's hull from near the bow back to almost the engine room, it was fortunate that the ship remained hard aground. Had he been successful in freeing the Valdez from the reef, there is a good possibility the ship would have sunk, causing an even greater disaster.

Having finally accepted the fact that we had a huge ship hard aground and spilling oil, the response organization swung into action. Complicated by darkness and a location 25 miles from the closest village of significance, the response was agonizingly slow and inadequate. Accumulating enough barrier and transporting it to the scene was problem enough but getting it around a rapidly spreading spill effectively, was a mission impossible. There simply weren't the facilities, or the technology available to accomplish this.

Responding to Environmental Challenges in Central Asia and the Caspian Basin



Workers using high-pressure, hot-water washing to clean an oiled shoreline. In this treatment method, used on many Prince William Sound beaches, oil is hosed from beaches, collected within floating boom, then skimmed from the water surface. Other common treatment methods included cold-water flushing of beaches, manual beach cleaning (by hand or with absorbent pom-poms), bioremediation (application of fertilizers to stimulate growth of local bacteria, which degrade oil), and the mechanical relocation of oiled sediments to places where they could be cleaned by wave and tide action.

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The concept of burning the spilled oil was considered, but by the time the decisions were made to do that, it was too late. The light ends of the crude oil, which makes burning a reasonable solution, had evaporated. Several days passed before burning was attempted and it was found that kerosene had to be added to the surface to get it to burn. Fighting pollution with more pollution is not something that the U.S. public is willing to accept.

Dispersants sprayed on the spill might have been of value but the decision to use them was again, slow in coming, with the result that when tried, they

were ineffective. Use of dispersants too, is not something our public fondly embraces.

And, herein lies the real problem with any oil spill. Unless the decisions are made in advance, with the local On Scene Coordinator given the authority to respond to a spill in an aggressive manner, a spill is usually going to make its way to the shoreline where cleanup is a major undertaking.

Cleaning oil from a shoreline raises many questions, most of which hadn't been answered in the spring of 1989. While there are some who would argue that

Responding to Environmental Challenges in Central Asia and the Caspian Basin



When crews cleaned a beach with high-pressure, hot-water washing, booms were used, as shown here, to prevent oil refloated by the cleaning operations from escaping back into Prince William Sound.

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ignoring a spill and letting the natural forces of nature take its course, this is not a popular opinion and certainly was not an option 10 years ago. Faced with a polluted shoreline, ranging from heavily covered with oil to some which was merely covered with drops of oil, we had to decide which methods were going to be used in which locations. Drops of oil of course, can be picked up by hand. This was done very effectively.

It was the heavily covered shoreline that provided the real challenges. In some cases, where the shoreline was beach-like, removal with front-end loaders was a practical method. Unfortunately, much of the shoreline in Prince William

Sound and other parts of Alaska, is rocky and in the worse case, is not suitable for machinery or people to be put ashore. Special equipment had to be devised for these shoreline areas.

The general concept for cleaning shoreline was to wash the oil off the beach, capture it in barriers in the water, and then skim it with mechanized skimmers into tanks to be hauled away. Unfortunately, oil does not lend itself to easy removal. While the use of aggressive surfactants would help the removal, they too would get into the water, possibly causing more damage to the environment than the oil. For the most part, the cleanup of the Exxon Valdez spill was relegated to using hot water,

furnished from barges to hand hoses on the shoreline. In those cases where personnel couldn't be put ashore, giant cranes (we called them "cherry pickers") with nozzles attached, were mounted on barges and were used to spray the shoreline. Obviously, the logistics of putting together the equipment and manpower to have an effective pollution removal operation was a major challenge. We were fortunate that the Exxon Company had vast resources at its disposal worldwide, but even Exxon couldn't do it alone. While they had to pay the bill, almost every government organization was called upon to help in the cleanup. Because this spill had the attention of the nation and the President of the United States, I as the Federal On Scene Coordinator, had a broad spectrum of resources at my command. A major player quickly became the Armed Forces of the U.S.

Despite Exxon's obvious capabilities, it was no match for what was needed in Alaska. Because the spill site was so isolated from any major population centers, equipment, transportation and hotel facilities became challenges well beyond any such operation in the past. We needed thousands of people; we needed heavy equipment (bulldozers, cranes, pumps, water heaters, generators, hosts, barrier. etc.);

we needed hotel facilities, which could provide round-the-clock food and bed facilities for over 12,000 people; and the list goes on. And of course we had to get these in huge requirements from all over world.

How did we do this? Generally, Exxon found what they needed in the way of equipment and supplies wherever it was available and if they couldn't get in a timely fashion through commercial delivery services they came to me with a request. I would normally call the Air Force General at Elmendorf Air Force Base at Anchorage who had been assigned by the Pentagon to be my Defense Department liaison officer, and he would provide whatever was needed.

A major player quickly became the Armed Forces of the U.S.

As an example, Exxon found that there was some equipment in Oslo, Norway that they needed without delay. They phoned me with the request and within minutes I was on the phone with General McInerney in Anchorage. That evening there was an U.S. Air Force, C5A in Oslo loading the equipment. The next day it arrived. This event was not unusual.

All the Armed Services were involved, however. We used Navy salvage crews, Navy ships, and Navy skimmers. The Army provided personnel and as unlikely as it sounds, some boats and skimmers. Marines helped as well.

Of particular note were the Navy hotel ships. Because of the isolated location of operations, they were particularly useful. For several months, over a thousand workers were housed on site, in relative comfort.

While the U.S. Coast Guard is one of the five Armed Forces in the United States and among other things, is responsible for supervising maritime spill cleanup, it is relatively small. Without the full and complete cooperation of the other services, the Valdez cleanup operation would have been impossible.

Perhaps the greatest challenge beyond the logistics and the physical problem of getting oil off the shoreline was the politics of cleaning up. In the United States, the person primarily responsible for insuring the proper clean up of an oil spill is called the Federal On Scene Coordinator (FOSC). That person must coordinate the cleanup activities among the many agencies involved. Being a "Coordinator" is not equal to being a "Commander". The

difference is significant. While the Coordinator could make all kinds of decisions in the Valdez spill cleanup, those decisions could always be effectively vetoed by the State of Alaska, the Environmental Protection Administration (EPA), Occupational Safety and Health Administration (OSHA) and many, many, others. To ignore those organizations was to risk being stopped by a federal or state judge. Meanwhile, the Exxon organization, which had taken full responsibility for the spill cleanup, looked to the FOSC for direction – who was often not able to make decisions in a timely manner.

We used Navy salvage crews, Navy ships, and Navy skimmers. The Army provided personnel and as unlikely as it sounds, some boats and skimmers. Marines helped as well.

Two examples of this weakness:

There was some evidence that there were products available that would have greatly enhanced the removal of oil from the shoreline. Despite the fact that much testing had been done before the Exxon spill, there were the many interests mentioned previously who resisted adding anything to the environment – anything, no matter how benign. In order to

test some of the additives, which Exxon wanted to use, a test area on a shoreline was finally authorized. It was divided into squares with additives applied to each one. Each square was protected by a double barrier to keep it secure.

After observing the squares for a number of days, recording the results of each, a fertilizer developed by the French for the enhancement of the naturally occurring microbes, was the obvious choice (bioremediation). Within 10 days of being applied, the rocks were clean. It took several weeks of "study" to finally authorize its selective use, however. This was in late July and it had been previously agreed that September 15th was the shutdown day for the cleanup operation because of the bad weather that could be expected at that time of year. Time to get the fertilizer from France and apply it was fast disappearing. To make matters worse, Exxon needed many more tons than was available from the factory and that factory was scheduled to shut down in August for annual vacation. Exxon finally prevailed upon the management of the factory (for a price) to keep it open to get the fertilizer they needed.

It was a well-known fact that the French had developed this fertilizer for the specific purpose of cleaning shorelines. Had the

decision been made early on to use it, I'm convinced that the cleanup would have been far more effective during that six-month window we had in 1989.

The second example of the tough decision-making environment had to do with the disposal of refuse. Keep in mind that there were over 12,000 people collecting and making refuse from the spill every day during the 6-month operation. Disposal became a real problem. In a meeting which I had called which included all the interested parties, it was decided to incinerate as much of the waste as possible. Exxon immediately started scouring the county for something quickly available. Within days, two incinerators were located in the northwest lower 48 states, mounted on barges and sent to Alaska. Then the heckling began in earnest. One incinerator was never used and the other was only used for a week or so before it was forced to shut down. Five million dollars wasted!

The really bad part of our failure to incinerate the refuse was that it all had to be barged down to premium landfill in Oregon. By premium, I mean that the U.S. doesn't have many of those landfills where hazardous substances can be dumped. To fill it with something as benign as oil waste didn't make much sense.

At the end of the summer of 1989, much had been accomplished in cleaning up the oil spill. Exxon had spent some 2 billion dollars on a major operation that on some days looked like the Normandy Invasion. Thousands of people saw parts of Alaska that probably never been exposed to human habitation. Fishermen rented their boats to Exxon for huge amounts of money, enabling many of them to payoff their mortgages. Native Alaskans, many of whom had never worked outside of the home, were employed for weeks on end, making over \$16 an hour. The very fabric of the society of Alaska was changed and probably not at all for the best. But it was Mother Nature that probably was most effective in cleaning up the Alaskan waters and shoreline. The fierce winter storms miraculously removed oil which had been so resistant to the efforts of mere mortals. A visit to the sites in the summer of 1990 showed mostly clean shorelines, inhabited by mussels and wildlife. Fishing was good and although there are those that

still complain, truth is Prince William Sound is pretty much back to normal.

This is not to say that we can spill oil without consequences. We must be better trained to avoid spills and when the unthinkable occurs, be prepared to fight it with every tool have. We have to keep in mind that as our preventative measures improve, there will be fewer spills and that must not lead us to complacency. It's all too easy to allow our emergency plans and equipment languish when we haven't had a spill for a while. We must resist that temptation.

Further, it is important to have the emergency planners prepare to utilize all the facilities available – both in your own country and outside. We found that we had help from every country that had experience in spill disasters. The key to success however, is timeliness. Pre-planning and cooperative agreements before disaster strikes will help avoid costly mistakes and delays.

RESPONSE TO THE FLOODS IN MOZAMBIQUE: A CASE STUDY



By Mr. L.J. Buys
and
Professor Bernard F. Griffard

Prior to discussing the 2000 South African flood relief effort in Mozambique, I believe it is beneficial to note that history may be repeating itself. On February 27, 2001 the Department of Foreign Affairs (DFA) reported that they had a request from the Government of Mozambique to render some evacuation and other assistance to the victims of the flooding in Mozambique. The request was forwarded to the South African National Defence Forces (SANDF) and also forwarded via the Minister of Foreign Affairs to the President.

The Current Situation

The President instructed that the following aircraft be identified to give the necessary assistance to Mozambique:

- 4 x Oryx helicopters
- 2 x BK helicopters
- 1 x Casa – for transport of fuel for disaster area
- 2 x C130 aircraft

These aircraft were placed on standby. Their deployment was initially delayed due to uncertainty about what agency would be responsible for the funding of the exercise at an estimated cost of R12m. This was a critical decision because of the resource impact the 2000 flood relief effort had on SANDF flight hours and training.

The Evolution of Natural Disaster – February 2000

Two major tropical low-pressure systems crossed Southern Africa from east to west during February 2000, resulting in torrential rains and floods that caused widespread destruction of infrastructure and livelihoods in South Africa, Mozambique and Zimbabwe.

These depressions had particularly long life spans, causing huge quantities of moist air to flow on-shore. This unusual occurrence resulted in exceptionally large quantities of rain over relatively long periods. Monthly rainfall totals exceeded 1 000 mm along the eastern escarpment, and many rainfall stations recorded total rainfalls during February of more than

Responding to Environmental Challenges in Central Asia and the Caspian Basin

600% (more than 900% in some places) of the average February rainfall.

In South Africa primarily the Northern Province, Mpumalanga, KwaZulu-Natal and the Eastern Cape Provinces were struck. The whole of the Limpopo catchment, extending as far south as the Crocodile River in the North West Province, and the Crocodile and Sabie Rivers in Mpumalanga were affected.

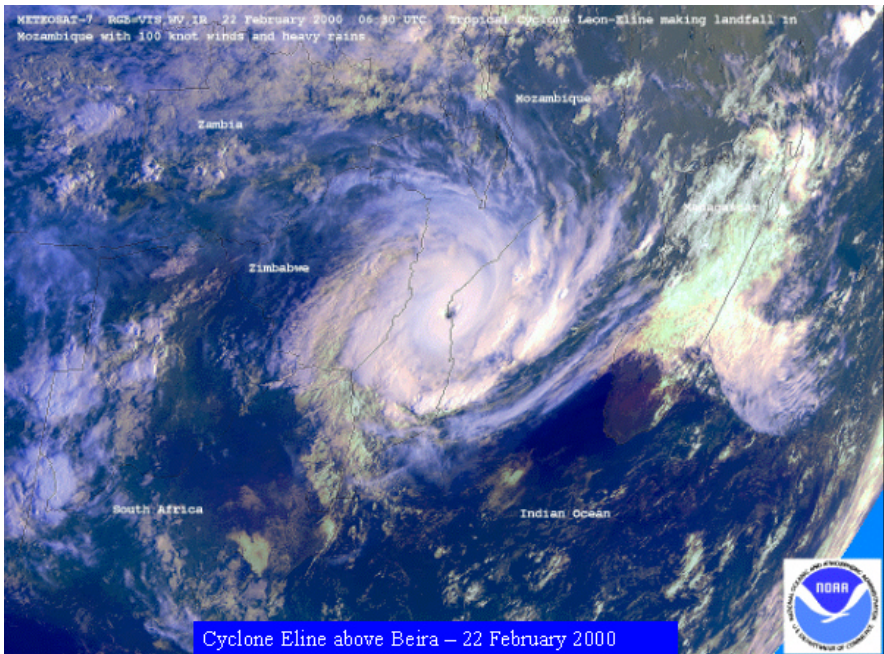
Preliminary calculations indicate that some of the largest floods on record were experienced. Record flows were observed in the Komati River where it enters Mozambique, the Crocodile River (in Mpumalanga), the upper

reaches of the Letaba and Sabie Rivers, and the Limpopo where it enters Mozambique at Pafuri. Flood peaks over wide areas were at levels expected only once every 20 to 50 years. At the Mozambique border, the Komati River flood was probably a one in 200-year event and in the Limpopo, a one in a 100-year flood.

In the Komati River, the preliminary estimate of the flood peak - 11 200 cubic metres per second (cumecs) - is the highest that could be traced from hydrological records and historical references that date back to the late 1800s. The flood levels were more than five metres higher than during the 1984 Domoina floods, which were previously regarded as the worst



South Africa : Komati/Crocodile – 7 February 2000



in living memory. Particularly acute floods were experienced where floods from several rivers came together as in the Limpopo where major inflows downstream of Beit Bridge from the Sand, Luvuvhu and Mutale Rivers contributed to one of the worst flood events ever observed at Pafuri, where the Limpopo enters Mozambique. Apart from these exceptionally high flood peaks, in other river systems much of the damage was caused by the long periods of very high flow rates and the associated extended inundation.

Two Major Storms

A tropical depression moved in a southward direction from

Beira and then continued in a westerly direction into Zimbabwe, Botswana and South Africa where it sustained itself during the period 4 to about 14 February 2000. This storm dumped enormous amount of rain during its two weeks of activity. It primarily affected the whole Limpopo catchment extending as far south as the Crocodile River in North West Province and the Crocodile and Sabie Rivers in Mpumalanga. The rivers had barely had a chance to subside when tropical cyclone ELINE caused extensive rainfall over northern Mpumalanga and the Northern Province.

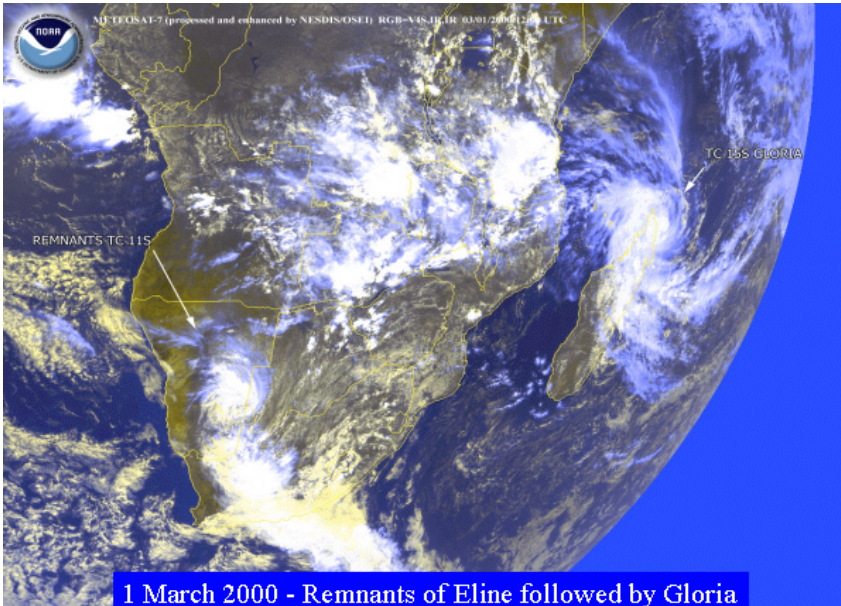
Tropical Cyclone ELINE started out as a tropical disturbance

over 2500 km east of Mauritius on 8 February. By 22 February, it was lying 80 km off the coast of Beira, and its status had been upgraded to an intense tropical cyclone. Its center crossed the Mozambique coastline approximately 90 km south of Beira on the afternoon of 22 February 2000. On 23 February, ELINE was located overland about 200 km southeast of Harare. Although weakening it dropped additional large amounts of rain over the northern parts of South Africa, and over Zimbabwe and southern Botswana. Heavy rainfall continued until 25 February 2000 over northern South Africa, and persisted until the end of the month in Botswana and Namibia.

South African Government Objectives

In Mozambique, more than 500 000 people were left homeless by what have been termed the worst floods in 50 years. The flooding in Mozambique resulting directly from the effects of the cyclone was compounded when the rivers that flow through Mozambique to the sea from South Africa, Botswana and Zimbabwe caused massive quantities of water to pour into the already devastated region.

Due to the magnitude of the humanitarian disaster and the inability of the Government of Mozambique to respond, the South African Government made the decision to render evacuation and other assistance to the victims of the flooding. As the



primary operator the SANDF set out to achieve the following South African government objectives.

- Coordinate national and international search and rescue operations
- Coordinate the provision of emergency supplies to Mozambique
- Involve and coordinate the SA Aero Club efforts from Nelspruit
- To re-establish the railway link between SA and Mozambique
- Provision of fresh water to Maputo

Joint Military Operations Center

To achieve its objectives the South African Government required the special skills and equipment only available in the SANDF. To manage this military support to civilian authority a Joint Military Operations Center was authorized by the South African Government through the South African National Disaster Management Centre.

As operations got underway AFB Waterkloof served as the central depot for all South African relief aid, and an air bridge was established between AFB Waterkloof and Maputo to move relief aid, medical and food supplies, rescue workers and doctors into the area of

operations. AFB Waterkloof was also established as the coordination center for international relief efforts.

Operation Litchi: Period 6-13 March 2000

During the critical 6-13 March 2000 timeframe, identified by the SANDF as Operation Litchi, a major effort from made by the South African Government to get relief supplies to the hardest hit areas. Supplies airlifted to Maputo from South African airbases amounted to 407,658 kg's. Rail transport from AFB Waterkloof to Durban to Maputo contributed another 315,000 kg's. International support was routed into AFB Waterkloof and other airbases where it was then moved to Maputo.

International Donations and Tonnage Airlifted

- Portugal- AFB Louis Trichardt (52,000kg)
- USA- AFB Durban (92,000kg)
- Belgium- AFB Waterkloof (76,181kg)
- USA- AFB Waterkloof (70,267kg)
- France- AFB Waterkloof (4,114kg)
- Germany- AFB Waterkloof (1,704kg)
- Portugal- AFB Waterkloof (84,114kg)
- SAFAIR- AFB Waterkloof (11,941kg)

This intense effort was expensive. The approximate cost to the South African taxpayer was R16 million (US \$2M). It is important to remember that disaster response is not free. It impacts on national budgets and may have long term effects when there has been employment of military equipment and other assets.

Lessons Learned

At the conclusion of the relief efforts the South African National Disaster Management Centre reviewed what had occurred and extracted three major lessons learned. First, the unclear protocols for allowing foreign relief agencies into a Southern African country during a disaster complicated and initially slowed the delivery of international aid. Second, the uncoordinated distribution of emergency supplies resulted in supplies not reaching those who needed it most. Finally,

there was a lack of coordinated logistic support infrastructure.

Conclusion

The South African Government achieved the goals it had set out for itself at the start of the relief operations. Much of the credit for this success belongs to the planning and coordination efforts of the South African National Disaster Management Centre and the professional capabilities of the SANDF. They contained the effects of the 2000 Mozambique flood through air rescue operations, the reinstatement of rail and communications services, coordination of international relief efforts, the provision of trucks, aircraft, personnel and other expertise, and the transport and delivery of food, clothing and medical supplies. Since the SANDF had to take control of logistics in Mozambique, they were involved till long after the immediate crises period.

CHAPTER 3 - *Regional Focus: National Experiences*

Panel Moderated by Dr. Bryan Shaw

Caspian Basin Analysis

Dr. Brian Shaw

World Bank

Mr. David Pearce

Organization for Security and Cooperation in Europe

Ambassador Marin Buhoara

Kazakhstan - National Experiences

General Major Uraz K. Rakyshev

Kyrgystan - National Experiences

A. Sarigosv

Tajikistan - National Experiences

Colonel Mamadaliev Bakhrom

Turkmenistan - National Experiences

Colonel Rakif Turayev

Uzbekistan - National Experiences

Colonel Rinat Zalyaletdinov

PAPERS

*A Systematic Approach to the Problem of Harmonizing the
Activities of the Military in Ensuring Ecological Safety*

Colonel Pernahan Yermekbaev and Mr. A. Kuandykov

*The Contemporary Geotectonic State of the Aral Sea
Basin and Associated Natural Processes*

Mr. Anvar Nurkhodjaev

ENVIRONMENTAL BASELINE ANALYSIS OF THE CASPIAN SEA REGION

*Brian R. Shaw
Terry Paluszkiwicz
Susan A. Thomas
Ann S. Drum
Peter Becker
Lyle F. Hibler
Charles Knutson*

The independent countries surrounding the sea are Russia, Azerbaijan, Iran, Turkmenistan, and Kazakhstan. Although the Caspian Sea lies inland, thousands of kilometers from the oceans, it has many marine characteristics and one connection to the Black Sea via the Volga-Don River network. It supplies food, water, industrial opportunities, and oil and gas to its surrounding nations. The past history of the Caspian Sea reveals an environmental system that is highly stressed by natural factors and human use. Into this already stressed system, the future development of oil and gas resources has the potential to introduce environmental impacts that could add fuel to existing regional tension around national security, fishing resources, water quality, oil and gas rights, pipeline routes, and land use. It appears that there is a significant potential for the environmental events to help trigger instability among the bordering nations of this region. The following report presents a baseline of the environmental status and stresses in the Caspian Sea region together with a brief framework of the regulatory issues. From this baseline, the issues that have the potential to escalate tensions in the region are highlighted.

Environmental Baseline

Environmental Setting

The Caspian Sea is usually described as having three basins: northern, middle, and southern. Other notable physical features are the Volga River, which drains 1,380,000 km² and contributes 78% of the annual water input

to the Caspian Sea, the Volga River delta, and the Kara Bogaz Gol Gulf.

Regulatory Baseline

The main legal issue in the Caspian Sea region rests on the definition of the body of water as a *sea* or as a *lake*. In the former case, the Geneva Convention on the Sea-Shelf of

1958, and the United Nations Convention on the Law of the Sea (UNCLOS) would apply; if it were defined as an inland lake, it would not be covered by these laws. If UNCLOS were applied, the sea would be legally partitioned to national sectors by equidistant division of the sea and undersea resources. Of the five littoral states, Azerbaijan and Kazakhstan call for UNCLOS to be applied; Kazakhstan adds that cooperation on the environment, fishing, and navigation would be beneficial. The Russian and Iran argue that the enclosed Caspian Sea, defined as an inland lake, should not be governed by the UNCLOS, but rather, that each nation should have a 45-nautical-mile exclusive economic zone (EEZ), with joint development and management of resources in the area beyond the set boundaries. Environmental protection, and resources such as fisheries and oil could be managed or developed jointly outside the EEZs.

There are several treaties and agreements for international cooperation in the Caspian Sea region, some with support from the World Bank and other agencies. Within the littoral states, there are various levels of regulation and interest in environmental issues. Other joint efforts and treaties in the region are concerned with oil

development and transportation issues.

Sea Level Changes

The rising sea level in the Caspian has been attributed to a combination of factors that include changes in river drainage and water use, increased precipitation, reduced evaporation, oil pollution, and tectonic shifts. The 1.5-m sea level increase is creating regional problems due to inundation of coastal regions, salt water intrusion, loss of homes, loss of fisheries and resources, transportation infrastructure, and threats to human health.

Water Quality

Water quality of the Caspian Sea has been on a continual decline over the past years. Sewage and wastewater from Russia are entering the Caspian via the discharge of the Volga River. Large and more pressing issues are the historic petroleum industry, post-Soviet burgeoning oil and gas development, and corresponding incidents of oil pollution. Some effects are seen in the decline of the sturgeon and caviar production, a major economic resource and cultural identity issue. In addition, reports of ecological damage from the persistent use of DDT as a pesticide and from toxic defoliants used in cotton

production need to be evaluated.

Nuclear Baseline

In the Caspian Sea region of Central Asia, there are several nuclear reactors used for power production and research, and many nuclear sites remaining from activity of the FSU, including those of uranium mining and production, nuclear waste dumping, storage, fuel production, and peaceful nuclear explosions. There is potential for leakage from some of the latter sites, exacerbated in some areas by the inundation resulting from Caspian Sea level rise.

Fisheries

Fisheries in the Caspian Sea in general do not present a point for potential regional conflict. Most major commercial stocks are mobile and at stock levels beyond present harvest capability due to fisheries infrastructure failure in former Soviet Union (FSU) countries. High-profile species such as sturgeon are at risk, but their decline would affect only local populations of harvesters and poachers on a seasonal basis. Alternative sturgeon and caviar sources in Iran, the North America, and China and the usual market forces mean a supply of caviar and smoked sturgeon will exist for export markets, even if the major

sturgeon fishery on the Volga delta were to fail. The Caspian seal is likewise not a major issue at present, because stocks must be controlled as long as fish stocks remain low. Water pollution issues seem to be declining in the face of industrial shutdowns in the FSU and International Standards Organization (ISO) environmental restrictions on products destined for the European Union (EU). Poaching is a local and seasonal issue in the north and mid-Caspian, and will likely decline with the increase in catch per unit effort that accompanies over-harvest; sturgeon in short supply would no longer be an easily available resource.

Oil and Gas Development

A critical issue facing the region is the development of oil and gas reserves. The Caspian Sea and associated basins have been projected to contain the third largest reserve of oil and natural gas in the world, behind the Gulf region and Siberia. Drilling for oil in the region is not new. Oil derricks dotted the landscape during the latter decades of the nineteenth century. Oil was a major source of hard currency for the FSU, but drilling methods were technologically inferior compared with those of Western firms for large-scale oil exploration. This inhibited Soviet exploration in the

Caspian region. In the mid-1980s, the Soviet Union's oil exploration sector was poised to reap benefits from the Western technology and investment; the breakup of the Soviet Union, however, put a hold on these plans, because several nations claimed sovereignty in the FSU lands around the Caspian Sea.

There are significant environmental concerns associated with drilling for oil in the Caspian region, in addition to those of the act of drilling. The major political as well as environmental issue is the best way to deliver the oil to world markets from the landlocked Caspian region. The most efficient oil transport likely would be by pipeline, but the exact route is undecided, and may prove to be the single most important factor in determining the ultimate success of oil exploration in the region.

Heavy tanker traffic thorough the Mediterranean, Red Sea, and Persian Gulf have already alerted states to the pollution potential of such activities. Increased production in the Caspian region could increase the above effects, no matter which pipeline route is eventually chosen. Unique to the Caspian region, however, are the ongoing sea-level changes. The sea could rise possibly 3m in the next 25 years, with consequent environmental damage. In the

last decade, it rose 1 m, already inundating some parts of Baku. Some of Iran's most productive fields lie on the southern shores of the sea and could be submerged if the sea were to continue to rise.

Environmental Vulnerability

Even if there were a single country that surrounded the Caspian Sea, there would still be problems and tradeoffs in solutions related to the sea level rise, pollution, and resource development; that is, the environment would still be vulnerable to damage, regardless of national politics. However, because there are multiple countries involved, shared legacy pollution and management issues, emergent highly profitable resources, divergent cultures, and debates over the scientific explanations for the sea level rise, there is no doubt that there will continue to be environmental vulnerability associated with the Caspian Sea level rise.

Fisheries in the Caspian Sea in general do not present a point for potential regional conflict. Most major commercial stocks are mobile and at stock levels beyond present harvest capability due to fisheries infrastructure failure in FSU countries. High-profile species such as sturgeon are at risk, but their decline would affect only local populations of

harvesters and poachers on a seasonal basis. Poaching is a local and seasonal issue in the north and mid-Caspian, and will likely decline with the increase in catch per unit effort that accompanies over-harvest.

The most likely primary point for fisheries-related conflict comes from the mixture of religion, economics, politics, and fisheries aquaculture that exists in the southern Caspian Sea. Iran and Turkmenistan cooperate in aquaculture interests. Combined with the major investment in aquaculture in Iran and the desire to maintain hegemony in the south Caspian in oil and fisheries, Iran could possibly initiate local- to regional-scale conflicts, if its aquaculture program were seen to be threatened. Potential ecological threats could include those due to spreading pollution from shoreline sources or to introduced species in tanker ballast water, or to eco-terrorism over oil rights/boundary issues and poaching.

Impacts are possible from five general elements of the oil and gas industry: exploration; drilling; production; gathering, transportation, and distribution; and refining and processing. Each of these elements has unique activities and vulnerabilities. By far the greatest vulnerability to large-

scale environmental damage is the pipeline infrastructure. Given the overall age and condition of existing pipelines and the proximity to the Caspian shoreline, which is changing, the likelihood of severe compromise of the system is high. Nonetheless, there are several concerns associated with each element.

Introduction

The Caspian region is quickly emerging as a focal point for environmental security issues arising from international environmental tensions. The Caspian Sea has been and is becoming more economically important to the bordering nations for its abundant energy resources and unique fisheries resources. Following the breakup of the former Soviet Union (FSU), the Caspian Sea region became the focus of international energy firms, seeking to develop and use the potential reserves of oil and gas. The Caspian Sea had already commanded much attention scientifically, because of rising sea levels and depletion of the sturgeon fishery. Underlying the future of Caspian Sea and the use of its resources are the needs to resolve regional conflicts, provide economic and humanitarian assistance to distressed regions, achieve the removal of nuclear weapons and waste, and negotiate lasting treaties and agreements.

The independent countries surrounding the sea are Russia, Azerbaijan, Iran, Turkmenistan, and Kazakhstan. Although the Caspian Sea lies inland, thousands of kilometers from the oceans, it has many marine characteristics and one connection to the Black Sea via the Volga-Don River network. It supplies food, water, industrial opportunities, and oil and gas to its surrounding nations. The past history of the Caspian Sea reveals an environmental system that is highly stressed by natural factors and human use. Into this already stressed system, the future development of oil and gas resources has the potential to introduce environmental impacts that could add fuel to existing regional tension around national security, fishing resources, water quality, oil and gas rights, pipeline routes, and land use. It appears that there is a significant potential for the environmental events to help trigger instability among the bordering nations of this region.

The following report presents a baseline of the environmental status and stresses in the Caspian Sea region together with a brief framework of the regulatory issues. From this baseline, the issues that have the potential to escalate tensions in the region are highlighted. The Caspian Sea is the topic of some summary books, and in key areas, some

in-depth scientific information. Environmental impact statements from resource development firms, as well as overview of climate-related sea level rise controversies and intense debates over the decline of the sturgeon fishery are beginning to emerge. There is a wealth of information on the INTERNET; the various web sites feature each country's viewpoint and particular special interest viewpoints. The report below summarizes the environmental issues as they are featured in the overview documents, on the INTERNET, and from scientific journals. Although we include the information from the INTERNET, we treat it as unconfirmed, rather than as peer-reviewed information, and we seek to confirm the issues with the scientific journal articles.

Environmental Baseline

Environmental Setting

The Caspian Sea is unique in its size and its characteristics. As the world's largest inland body of water, located in a large continental depression about 27 m below sea level, with no surface outlets and with varying salinity and water levels, it is described either as an inland sea or as a lake (Figure 1). It is usually described as having three basins (Figure 2). Other notable features are the Volga

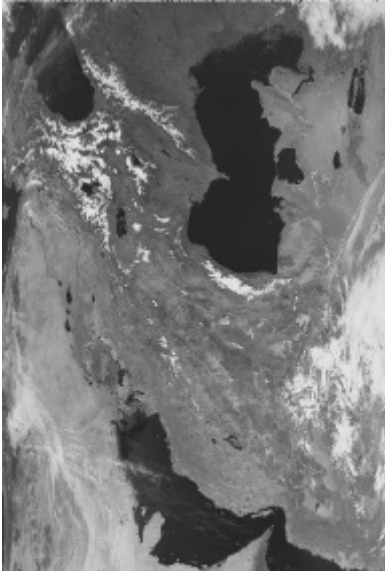


Figure 1. Remote image of Caspian Sea region advanced very high-resolution radiometer (AVHRR) image (Remote Sensing Group, Pacific Northwest National Laboratory)

River, which drains 1,380,000 km² and contributes 78% of the annual water input to the Caspian Sea (Kaplin 1995), its delta (Figure 3), and the Kara Bogaz Gol Gulf (Figures 2 and 4). Including the Volga, there are over 130 streams and rivers that flow into the Caspian Sea. In the northern Caspian, the Ural and Terek Rivers contribute 10% of river water; in the west, the Kura and some smaller rivers account for 7% of the inflow; and the remaining 5% is contributed by rivers in Iran (Figures 4 and 5). There is no river on the eastern littoral that reaches the sea (Kaplin 1995). As in other large, closed-basin lakes, the water level depends in part on the

balance between precipitation and evaporation (Rodionov 1994). A map of the catchment area of the Caspian Sea is shown in Figure 5. Basic characteristics of the Caspian Sea are shown in Table 1.

The Caspian is surrounded in the north and east by semi-desert lowlands and tableland deserts; in the south, it is bordered by a narrow coastal lowland strip at the base of the Alborz Mountains (Kaplin 1995). To the west are the Caucasus Mountains, and the Kur-Araks lowlands, much of which are below sea level to the

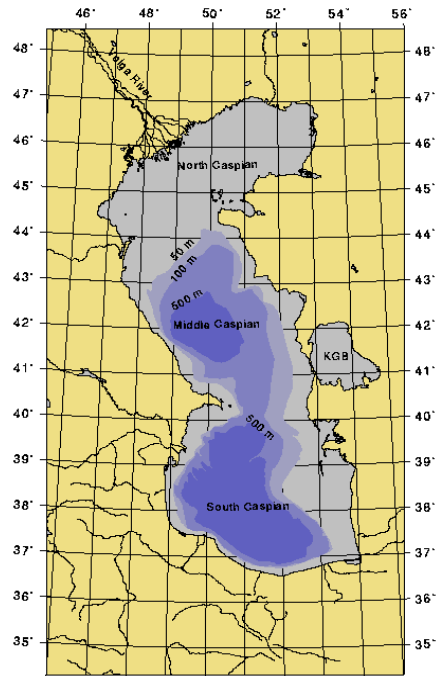


Figure 2. Caspian Sea Basins and Kara Bogaz Gol (KBG)

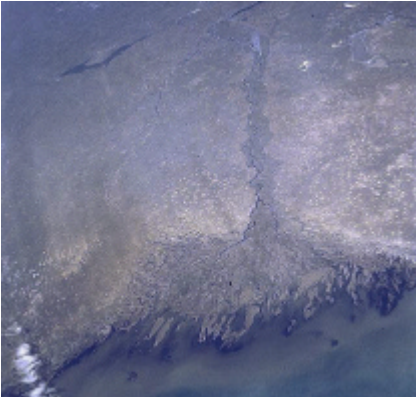


Figure 3 Volga River delta (satellite photograph NM21-704-056, NASA 1998)

north and south of the range and extending to the sea south of Baku (Figure 4).

Although the Caspian Sea contains over 40% of the world's



Figure 4. Map of the Caspian Sea vicinity (mapping software from Wessel and Smith 1991)

fresh lake water, surface salinity actually varies between 0 and 1 ppt in the north, near the mouths of the Volga and Ural Rivers, to 12 ppt to 13 ppt in the open part of the middle and southern Caspian Sea (Kaplun 1995) (Figure 6). However, salinity may reach 200 ppt in some enclosed bays (Karpinsky 1992). Historically, changes in the river outflow from the Volga River, anomalies in wind patterns, and fall of the sea level have resulted in salinity changes in some areas of the Caspian (Tarasov 1998). Sea surface temperature has a similar north-south asymmetry, due to the latitude difference over the sea (Kaplun 1995) (Figure 7). The northern sea is near 47°N; therefore, with low-salinity water feeding from the Volga and Ural Rivers, annual freezing takes place, and wind-

Table 1. Basic Characteristics of the Caspian Sea^a.

| Characteristic | Quantification |
|-------------------------------------------|--------------------------|
| Latitude | 36° 33' – 47° 07' N |
| Longitude | 46° 43' – 54° 03' E |
| Surface Area | 378,400 km ² |
| Volume | 78,100 km ³ |
| Length | 1030 km |
| Max. width (45 30 N) | 435 km |
| Min. width (40 30 N) | 196 km |
| Depth in north Caspian (max./mean) | 25/4.4 m |
| Depth in middle Caspian (max./mean) | 782/192 m |
| Depth in south Caspian (max./mean) | 1035/342 m |
| Catchment area, total | 3.5×106 km ² |
| Catchment area of Volga River | 1.38×106 km ² |
| Precipitation, mean (1900-1982) | 0.19 m/year |
| River runoff (1900-1982) | 0.77 m/year |
| Evaporation, mean (1900-1982) | 0.97 m/year |
| Sea level relative to oceans (Jan. 1995) | -25.5 m |
| Temperature of surface water, mean annual | 13° C |
| Temperature of bottom water, mean annual | 5.5° C |
| Salinity | 13‰ |
| Humidity over the sea, mean annual | 80% |

a) After Ferronsky et al. (1995).

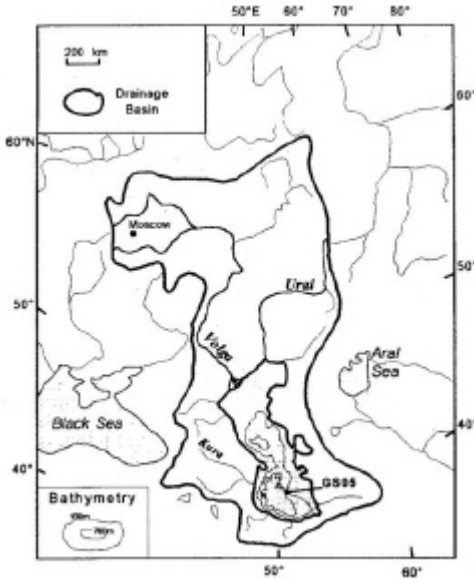


Figure 5. Map of the Caspian Sea catchment area (after Chalie 1996)

driven rafting of ice can produce up to 1 m ice thickness off the Volga delta in the area of the Kulaly Island seal fishery (Bukharitsin 1993). The southern sea remains ice-free below a line between Baku and Krasnovodsk, along latitude 40°N. During the summer, the temperature differential north to south is only 5°C, with

maximum temperatures near 22°C in the north and greater than 27°C in the south (Kaplin 1995).

The thickness of the seasonal thermocline in the Caspian Sea is determined by spring heating and the maximum wind-driven mixing depth. The difference in depth is due to the winter cooling that can produce convective overturning of the entire water column of the shallower north and central Caspian, but which only influences the top 100 m of the deeper south Caspian Sea. Because of this, bottom water temperatures reach 4.5°C to 5°C in the north and middle Caspian, but only 5°C to 6°C in the south Caspian (Kaplin 1995) (Figure 8).

Regulatory Setting

The main legal issue in the Caspian Sea region rests on the definition of the body of water as a *sea* or as a *lake*. In the former case, the Geneva



Figure 6. Mean perennial distribution of water temperature on the Caspian Sea surface: a) February; b) April; c) August; d) October (TES 1992, cited in Kaplin)

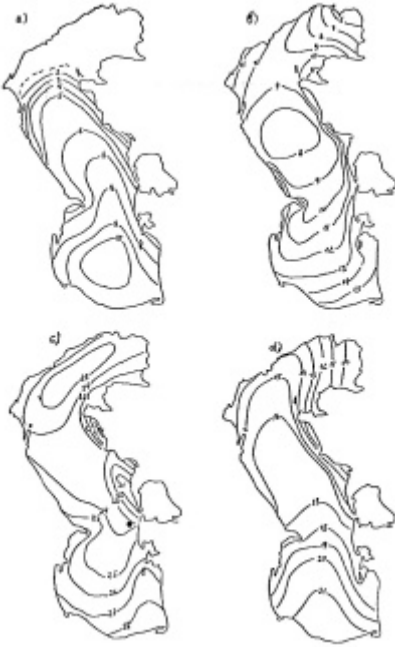


Figure 7. Average perennial distribution of water salinity on the Caspian Sea surface: a) February; b) April; c) August; d) October (TES 1992, cited in Kaplin 1995)

Convention on the Sea-Shelf of 1958, and the United Nations Convention on the Law of the Sea (UNCLOS; United Nations 1983) would apply; if it were defined as an inland lake, it would not be covered by these laws. If UNCLOS were applied, the sea would be legally partitioned to national sectors by equidistant division of the sea and undersea resources (Figure 9). Boundary lines would be extended from shore or from a nation's offshore islands an equal distance to the center of the sea. Under the former Soviet Union (FSU) delineation, the sea sectors for

Azerbaijan, Turkmenistan, Kazakhstan, and Russia were divided in this way for nearly 20 years; Iran's Caspian maritime sector was defined by regional treaties with the FSU signed in 1921 and 1940 (EIA 1997c). Of the five littoral states, Azerbaijan and Kazakhstan call for UNCLOS to be applied; Kazakhstan adds that cooperation on the environment, fishing, and navigation would be beneficial.

The Russians argue that the enclosed Caspian Sea, defined as an inland lake, should not be governed by the UNCLOS, but rather, that each nation should have a 45-nautical-mile exclusive economic zone (EEZ), with joint development and management of resources in the area beyond the set boundaries. Environmental protection, and resources such as fisheries and oil could be managed or developed jointly outside the EEZs (UNCLOS 1983). A joint corporation of the littoral nations could be formed to exploit the common resources, and all five members would have to approve any offshore oil developments.

Iran backs the Russian claims based on the 1921 and 1940 treaties, which gave fishing rights to Iran and to the FSU within a 10-mile coastal zone (or 12-mile zone, according to Akimov [1997]), with shared jurisdiction over the balance of

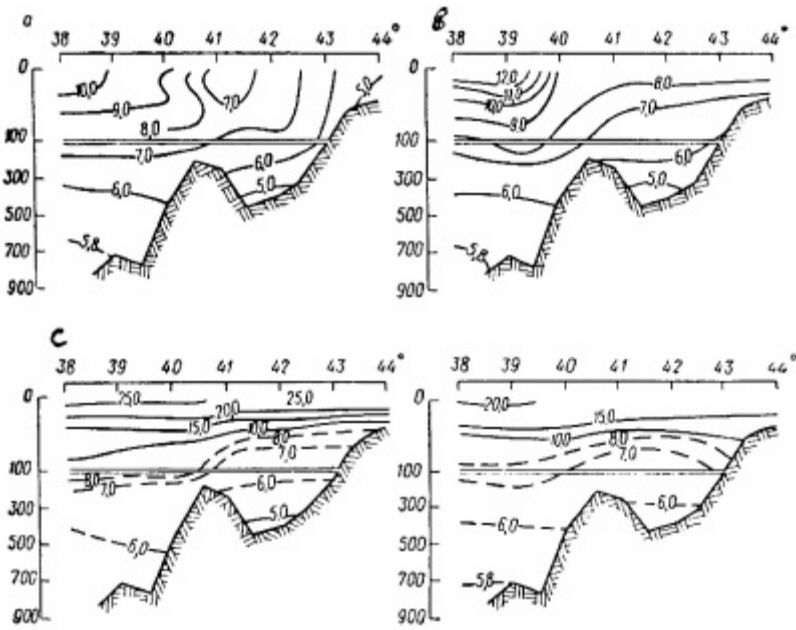


Figure 8. Distribution of water temperature in sea depths meridionally from north to south, 51°E, according to mean perennial data: a) February; b) April; c) August; d) October (Kosarev 1975, cited in Kaplin 1995)

the sea (EIA 1997c). By these agreements, none of the republics of the FSU held individual borders within the sea, because the entire sea was at that time “federal” property (TED 1997a). These treaties did not establish seabed boundaries, nor did they address oil and gas exploration rights.

Turkmenistan’s position has not yet been made clear. In 1996, it initially supported the Russian proposal of a 45-mile exclusive zone for each littoral nation, and signed a protocol with Iran and Russia toward joint development of the energy

resources. However, by early 1997, it had revised its position and signed a statement with Kazakhstan calling for the median-type boundaries established by the Soviet administration to be applied until the littoral states could agree on a new status for the Caspian boundaries. However, following a dispute with Azerbaijan over an oil field license, the position was again modified. The most recent presidential statement from Kazakhstan implies the median-line boundary preference; however, a final resolution has not yet been made (EIA 1997c).

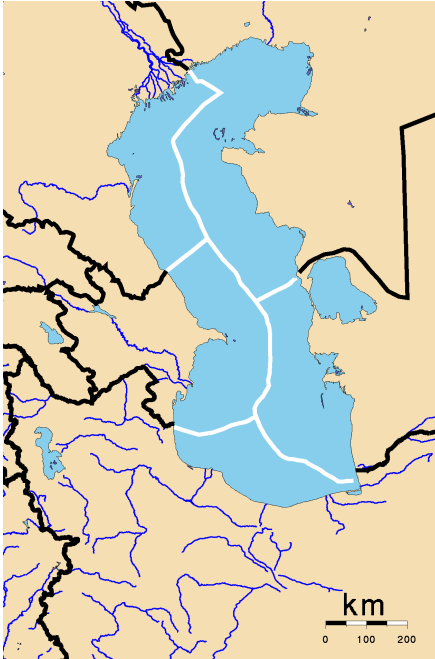


Figure 9. Caspian Sea maritime boundary lines of the five littoral nations. Boundaries are extended from shore or from each nation's offshore islands an equal distance to the center of the sea, drawn as if UNCLOS were applied. Proceeding clockwise from the upper left corner, the countries claiming sections of the sea are as follows: Russia (including the Volga delta); Kazakhstan; Turkmenistan; Iran; Azerbaijan.

As of October 1997, the U.S. supported in principle that the five littoral states must resolve the legal status of the Caspian Sea, and accordingly, the national boundaries within the sea area. Until mid-May 1998, the U.S. Presidential Executive Order, *the Iran and Libya Sanctions Act of 1996*, required the U.S. to penalize non-U.S. companies that invested over \$40 million per year in the oil/gas sectors of those countries. After 1 year, the allowable investment was

dropped to \$20 million for countries that did not join measures to inhibit Iran's actions that support international terrorism or pursuit of weapons of mass destruction (EIA 1997c). Currently, the U.S. has waived some of the sanctions on companies that deal with Iran, in particular, in the case of French, Russian, and Malaysian companies involved in a \$2 billion energy deal concerning the Caspian Sea (Jehl 1998; The Washington Post 1998). In July 1997, the U.S. State Department decided that proposed exports of natural gas from Turkmenistan to Turkey via Iran would not violate the law as it stands (EIA 1997c).

According to Dr. K. Yusifzade (1994), vice president for geology and geophysics of the State Oil Company of Azerbaijan Republic, there is a significant difference between fishing and mineral rights in the Caspian Sea. With mineral resources, the seabed rather than the water is the tangible standard: the method of division would follow the UNCLOS sector-division method. For the fishery, the exclusive-area/joint management rule would apply (Yusifzade 1994).

International Agreements and National Laws/Policies

Azerbaijan

In Azerbaijan, with a coastline of about 800 km¹ on the Caspian Sea (CIA 1997a; ENRIN 1997b), the State committee for the Environment made an effort, particularly between 1990 to 1995, to promote environmental/ecological education in the country, and to involve leading national and international specialists, along with representatives of the interested oil companies, to engage the public awareness of environmental problems of the Caspian Sea and other related issues in Azerbaijan (ENRIN 1997c). It has signed and ratified the United Nations conventions on climate change and ozone layer protection, and signed but not ratified that on biodiversity.

Iran

Iran borders the Caspian Sea for a distance of 740 km (CIA 1997b). It is a party to the

1 Of course, the shoreline of each nation cannot be precisely stated; its length depends upon the border determinations, and the level of the sea at any given time. The values shown in the text are taken from current reports, as cited. Kaplin (1995) listed the following: The shoreline is divided among five littoral nations. Beginning at the north end of the sea, and following clockwise, Kazakhstan has the longest shoreline, 2700 km; Turkmenistan has the second longest, 1200 km; Iran has close to 900 km of the southern coast; Azerbaijan claims about 850 km; and the Russian Federation has about 695 km.

following international agreements: endangered species, hazardous wastes, nuclear test ban and nonproliferation treaty, ozone layer protection, wetlands; biodiversity, climate change, desertification, environmental modification, Law of the Sea, and marine life conservation (Farhang va Andisheh Institute 1997). Iran's deputy foreign minister for Euro-American affairs has stressed Iran's policy that the Caspian Sea is a part of the national heritage of all the littoral states, and that although priority has been given to the exploitation of oil and gas resources in the sea, preservation of the Caspian environment is of great importance (*Tehran Times* December 11, 1995). The state fisheries organizations of Iran, which following the Islamic Revolution (1979) were eventually blended to a single state company called Shirat in the mid-1980s, has established a long-term development plan for development of fisheries and aquaculture, and for promoting the increase of consumption and export of fish by 2020. It considers biological and well as food security issues in its planning (Abbasian 1997).

Kazakhstan

Kazakhstan has at least 1894 km of coastline on the Caspian Sea (CIA 1997c). Since it became independent in 1991, it

has become a party to the United Nations agreements on biodiversity, climate change, and ship pollution; it has signed but not ratified an international agreement on desertification. It intends to become a member of the United Nations Development Programme (UNDP) Global Environmental Facility (letter of intent was submitted in 1995) (Zhunusova 1997). Toward this end, representatives of the Ministry of Ecology and Bio-resources of the Republic of Kazakhstan attended international meetings, an environmental assessment report was completed in 1996, and the Kazakhstan representatives participated in preparatory activities through 1995-1997 (ENRIN 1998). In 1997, Kazakhstan's National Environmental Action Plan for Sustainable Development (NEAP/SD) was completed with funding and support from the World Bank; it includes a schedule to prepare national programs and projects to tackle priority environmental issues (Daukeev 1998; Sievers and Aranvaev 1998).

Some doubt is expressed based on the vague wording of laws, limitations on potential lawsuits and on those that can sue for compensation for harm to the environment, and unresolved governmental environmental policies that in spite of official publication and discussion of environmental protection laws

in Kazakhstan, there will be little application and enforcement possible, (Kurotov and Svitelman 1997).

Russia

The Russian share of Caspian coastline is nearly 800 km (CIA 1997d). Although it considers the Caspian an inland lake, Russia has international treaties in force that would apply if the Caspian were defined as a sea. Among these are the following: International Convention for the Prevention of Pollution of the Sea by Oil; and Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention).

At regional meetings, Russia has expressed priorities of marine environmental preservation and ecosystem management, and a preference for practical regional cooperation programs that are action-oriented. In practice, however, Russia's environmental protection efforts are limited by financial considerations.

Turkmenistan

The Caspian coast of Turkmenistan extends about 1768 km (CIA 1997e). This country is a party to United Nations conventions on biodiversity, climate change, desertification, hazardous wastes, ozone layer protection.

Conflict and Treaties along Potential Oil Export Routes

In areas of possible oil pipeline routes, there are unresolved conflicts and some attempts at cooperation. The relationship between Russia and Azerbaijan has been strained over alleged arms shipments to Armenia (1993-1995); Armenia and Russia signed a friendship treaty in 1995, along with an agreement for Russia to supply Armenia with natural gas (EIA 1997c). The northern route for Azerbaijani oil passes through Chechnya, where there was nearly 2 years of armed conflict. A peace agreement cleared the path for a three-way cooperative settlement among Azerbaijan, Chechnya, and Russia to allow pipeline repairs and oil export from Azerbaijan, although it did not settle issues of regional security and pipeline tariffs (EIA 1997c).

Cooperation in Caspian Sea Region

Several joint commissions and organizations have been formed to try to encourage a cooperatively controlled development of the region, particularly as it concerns fisheries, oil and gas resources, and cooperation in environmental protection. One of the most profitable resources of the Caspian Sea is sturgeon, the eggs of which are the luxury food, caviar.

Historically, starting in 1917, the Bolsheviks established a state monopoly on caviar; more recently, the two largest exporters of this product, Iran and Russia, formed a joint venture to protect and conserve the Caspian Sea and its caviar-producing resources (TED 1997b). With the independence of the FSU republics, three additional nations were poised to share the sea's resources. In 1992, the five littoral states signed a memorandum of understanding (MOU) by which an organization was formed for Caspian Sea conservation, essentially to regulate the exploitation of marine resources (TED 1998b). International agreements provide for a total annual harvest of 250,000 metric tons (mt) of fish from the Caspian Sea (Hamlin 1998). This quota must be divided among the five nations sharing the resource, but the nature of the division depends upon resolution of the impasse described above, concerning the nature of the national boundary system (EEZs or median-line) to be exercised in the sea. A permanent international fisheries policy has not yet been determined for the Caspian; however, a joint scientific committee has been formed, supported by the United Nations, to consider appropriate management policies (Fish Farming International April 1997).

Law and Environment Eurasia Partnership (LEEP) is a 501(c)93 public charity formed under the auspices of and directed by six grassroots nonprofit nongovernmental organizations (NGOs) in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan), the goals of which are to improve existing environmental and nonprofit legislation in Central Asia, to develop conservation projects, to provide information to local NGOs, and to encourage Western support for civil society in the region.

In 1991, a conference on the *Creation of the Committee of the Caspian Countries to Solve the Problems of the Caspian Sea* was held in the Islamic Republic of Iran, attended by the Azerbaijani State Committee for the Environment, among others. The *First Baku International Conference on the Problems of the Caspian Sea* was attended by representatives of 158 countries. According to some sources, no outstanding result was achieved (Payam-e Darya 1995). Two years later, at a meeting in Tehran in 1994, a cooperation program was drafted and approved by representatives of all Caspian states, aided by various United Nations and World Bank participants, and committees were formed to consider problems of protection of the environment, assessment of sea

level change, marine transportation, legal matters, and Caspian Sea research (Payam-e Darya 1995; ENRIN 1997a, 1997b). This organization has also not yet achieved its objectives.

In 1992, a large group of experts in the Russian Federation published a technical and economic study on the Caspian Sea, in large part, toward encouraging cooperation of the littoral states in protecting the coast against possible encroachment of the sea, and on other ecological problems and conditions for the economic development of the region (TES 1992).

In 1995, representatives from the five littoral states established the *Caspian Sea Initiative* in collaboration with coastal governments, private sector, UNDP, United Nations Environmental Programme (UNEP), and NGOs to coordinate environmental protection and management of the Caspian, supported by a World Bank-executed grant of US\$500,000 from Japan (World Bank 1997a, 1997b).

The Presidium of the Azerbaijan Academy of Sciences formed an international center for the ecological investigation of the Caspian Sea, located in Baku, for cooperation between Soviet and foreign scientists. Research, expedition, and

laboratory facilities are supplied to the center by the Caspian Sea Biological Station, Institute of Zoology (Kasymov 1990). This cooperative effort focuses on topics of a) distribution of toxic substances in the sea and its river sources; b) the ecology of invertebrates, commercial fishes, and rare/disappearing species of the Caspian ecosystem; and c) on creation of an environmental monitoring system.

The World Bank has supported efforts to tackle the environmental issues of Central Asia by helping governments to develop NEAPs, which emphasize sustainable policy changes and further institution building. In fiscal 1997, the NEAP for Kazakhstan was completed; those for Armenia, Azerbaijan, Georgia, and Uzbekistan will be completed in fiscal 1998. The World Bank also continues its support of international programs to clean up the Caspian Sea (World Bank 1997a, 1997b).

There is a pilot program through the U.S. G-7 Global Inventory Project proposed as an entrepreneurial initiative, led by Technical Entrepreneurs Intrapreneurs Network (TEIN) to encourage the economic development and environmental protection/cleanup of the Caspian Sea. This project aspires to work with governments, educational and

research institutions, and businesses in the littoral states (including Iran, when U.S. foreign policy permits), to initiate environmental protection and remediation projects, aquaculture, infrastructure development, oilfield services, telecommunications, and tourism, all with an emphasis on joint ventures with regional entrepreneurs (Dey 1997).

In the arena of gas and oil development, there are many consortia, partnerships, and agreements among oil companies and governments of the nations surrounding the Caspian Sea, including those that do not actually have coastline on the sea, but which are involved in potential transport by pipeline or other related issues. For example, in 1994, a consortium of oil companies led by British Petroleum signed a contract with Azerbaijan to invest \$8 billion over 30 years for the development of oil resources and transportation by one of three possible routes (TED 1998a). Kazakhstan and China forged a contract for the latter country's investment in development of Uzen field development, and construction of an oil pipeline to China (Kasenova 1998). In 1997, the State Oil Company of Azarbeijan Republic (SOCAR) signed a production-sharing agreement with Mobil Oil for a

particular block of seabed off the coast of Azerbaijan, which gives Mobil a 50% working interest in the block. The importance of such an agreement is indicated by the presence of Vice President Al Gore, Secretary of State Madeleine Albright, and Azerbaijan President Heydar Aliyev at the signing ceremony in the White House (Slater 1997). Other agreements are discussed in the section on oil/gas baseline.

Caspian Sea Level

The Caspian Sea level has changed significantly in the past. The factors responsible for the variation are theorized to be *climatic* (such as atmospheric variations), *anthropogenic* (which have affected river discharges - especially that of the Volga River), and *geologic* (such as subsidence and neotectonic movements). The relative importance of these as they affect the Caspian Sea level is

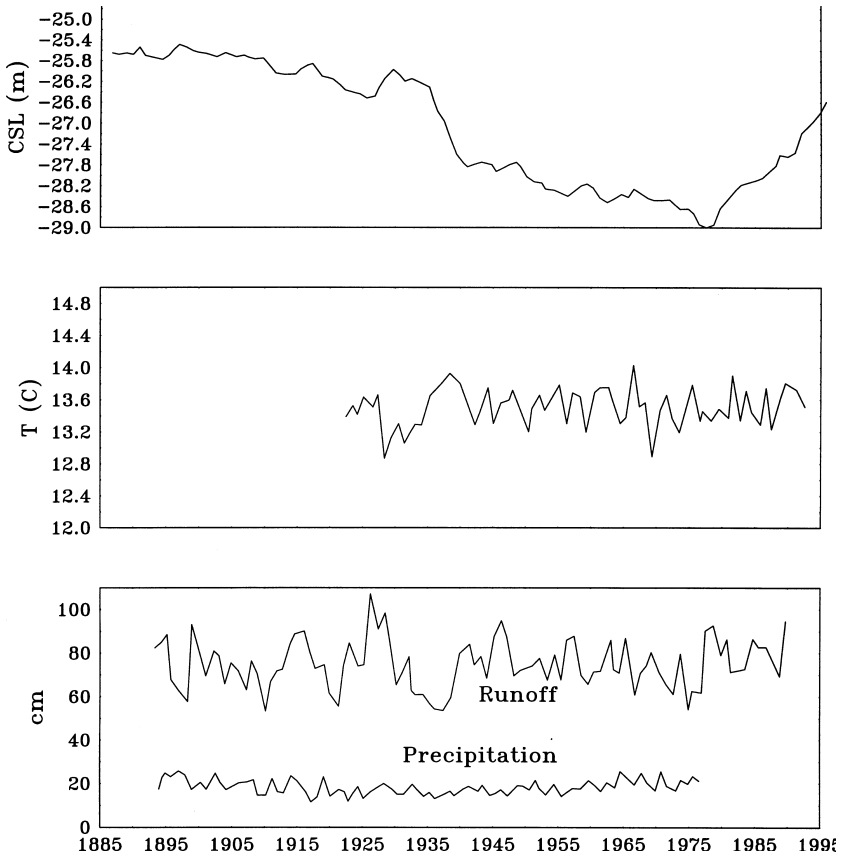


Figure 10. Time series of annual Caspian Sea level, runoff, precipitation, and temperature (after Ferronsky et al. 1995)

continually debated and not easily resolved. Climate, geology, and human influences are likely to be interlinked. Because there is no outlet from the Caspian Sea, it is widely accepted that the Caspian Sea level variations are related to variations in atmospheric forcing (i.e., net evaporation). The long-term trends in the Caspian Sea level, runoff, precipitation, and temperature are shown in Figure 10.

Tectonics - Shilo (1990) theorized that the degree to which runoff variation has led to variations in the Caspian Sea level has been overestimated, and that neotectonics and the resulting groundwater flow variations are more likely causes in Caspian Sea level variations.

Wind - Golitsyn et al. (1990) attributed the post-1977 rise in the Caspian Sea level to increased river discharge, decreased net evaporation, and to the blocking off of Kara Bogaz Gol Gulf. The important factors are the increased precipitation in the Volga watershed and over the Caspian Sea itself. Through statistical analyses, it was determined that the only factor that affects evaporation and that had significant variation was wind speed. No significant trends were found for air or sea temperature, or for humidity. Winds were found to have

decreased between 1960 and 1987. Decrease in wind speeds infers that a reduction in evaporation led to a Caspian Sea level rise. The wind trends are associated with large-scale fluctuations in atmospheric circulation.

Estimating Evaporation

Lobanov (1987, 1990) discussed the methods used to estimate Caspian Sea evaporation levels. The earliest estimate of evaporation on this sea was 1.085 m/year; this was accomplished by balancing precipitation and river runoff. Physically based estimates using wind speed and vapor pressure gradients yield values very close to the earliest estimated value above. Neither accounts for the possibility of groundwater sources or sinks; both are subject to uncertainty in precipitation levels. More highly parameterized evaporation rate formulation yields reduced evaporation estimates of 85 cm/year. More detailed and varied estimates yield similar values, ranging from 85 cm/year to 111 cm/year. The error of these estimates is stated to be 15%. These formulations take into account the vapor content (humidity) of the overlying air of the Caspian Sea. Global climate change can affect the vapor content. Therefore, these formulations and their incorporation of humidity can

be used to estimate the effect of global climate change on evaporation, and accordingly, also on the Caspian Sea level.

Panin et al. (1991) discussed their statistical analyses of the wind over the Caspian Sea and its relevance to the evaporation estimates. They statistically quantified the relationship between wind speed's downward trends and evaporation.

Forecasting

Meshkani and Meshkani (1997) applied a stochastic model to attempt to explain the trends in the Caspian Sea level and its fluctuations. They attempted to relate the present and past levels of the sea, of precipitation, and of temperatures. The goal of their research is to provide 5-year forecasts for the Caspian Sea level. *Their model indicates a continued rise in the Caspian Sea level.*

Vaziri (1997) developed stochastic models of the Caspian Sea level. Unlike the Meshkani and Meshkani (1997) work, the models developed by Vaziri use only past Caspian Sea levels as inputs. Vaziri's model was validated for making short-term (month to year) Caspian Sea level estimates. The models were accurate to +/-3 cm and were determined to be useful in planning.

Economics

Shayegan and Badakhshan (1996) discussed the causes of the recent (decadal) rise in the Caspian Sea and its economic effect on the coast of Iran. The possible causes of the Caspian Sea level fluctuations include the following:

- *Changes in hydrology*
- *Water withdrawals from the Caspian Sea for agricultural and industrial uses*
- *Tectonic movements*
- *Climate changes*
- *Inhibited evaporation from Caspian Sea due to oil pollution*
- *Diversion of water from outside of the Caspian Sea watershed*
- *The greenhouse effect and melting of polar ice*
- *Subsurface communication between Caspian Sea, the Black Sea, and the Aral Sea.*

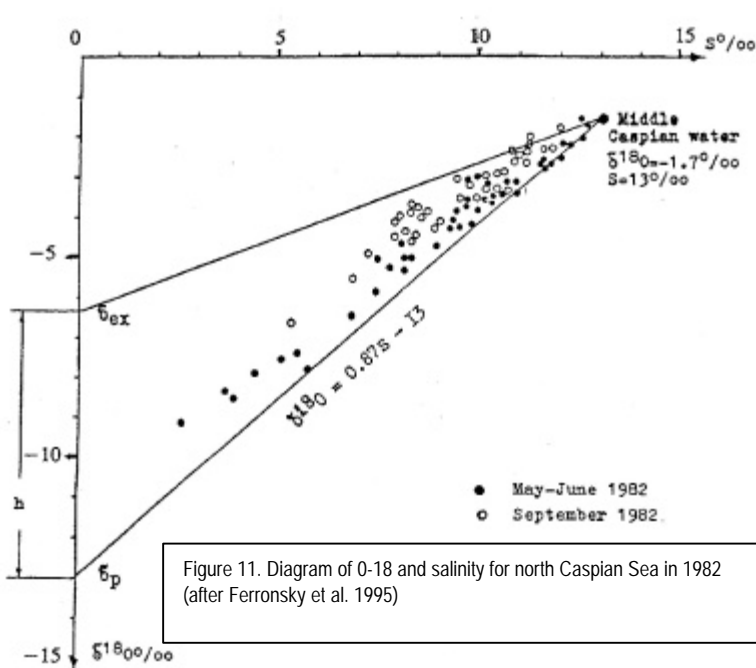
Shayegan and Badakhshan offered neither the significance nor the relative magnitude of influence of each of these potential causes of Caspian Sea level rise in their analysis.

Paleogeography and Radiodating

Rychagov (1997) reconstructed the Caspian Sea level based on paleogeographical analysis. The effect of neotectonics, sedimentation, and anthropogenic

factors on river discharge cannot explain the Caspian Sea level fluctuations. It was concluded that climatic factors are the most likely cause of the Caspian Sea level fluctuations. Detailed analysis was offered of the geology and geomorphology of the Caspian Sea coastal zone, especially at the river mouths. Radiocarbon dating of marine shells was used to reconstruct that Caspian Sea level for the last 10,000 years. In contrast to the results of Meshkani and Meshkani's (1997) forecast, these analyses indicated that the present rate of Caspian Sea level rise should decrease, and that the present Caspian Sea level is within the expected range given the reconstructed 10,000 year historical levels.

Ferronsky et al. (1995) used isotopic analyses (oxygen) and salinity measurements of river and Caspian Sea water to aid in the quantification of the mixing of these two waters. Their analyses indicate that the Caspian Sea is divided into three zones: north, middle, and south. Each of these zones contains a different mix of river runoff, as indicated by the salinity and oxygen distributions (Figure 11). The degree of vertical mixing in the middle and southern zone was investigated by measuring tritium profiles. Through these analyses, Ferronsky et al. theorized that the increase river runoff, with its temperature lower than that of the Caspian, has led to a reduction of evaporation. The tritium



analyses indicated that during the 1990s, complete vertical mixing was established, which should lead to stable density profiles. This in turn should lead to a warmer surface layer and increased evaporation; increased evaporation could then lead to a drop in Caspian Sea level.

Remote Sensing

Cazecave et al. (1997) reported on the usage of TOPEX/POSEIDON imagery for assessing the Caspian Sea level. They reported that the Caspian Sea level was decreasing by mid-1995 and continuing to decrease in 1996 at a rate of 25 cm/year, whereas it had been increasing during the previous periods at rate of 19 cm/year. Use of the synoptic observations allowed Cazecave et al. to show that the Caspian Sea level fluctuations were not spatially uniform. The rate of the Caspian Sea level rise in the north was 3 cm/year greater than it was in the south.

Hydrologic Balance

Hydrologic balance models have been used to investigate the relative magnitudes of the sources and sink of water within the Caspian Sea (Rodionov 1994). Rodionov (1994) concluded that alteration of the flow due to human activity from the Volga to the Caspian is a secondary but

significant factor relating to long-term, nonseasonal variations of the Caspian Sea level, but can be contributing up to 70% of the seasonal Caspian Sea level. *Sources* of water include runoff (R), precipitation (P), and groundwater flow (G); *sinks* include evaporation (E), and discharge of water through the Kara Bogaz Gol Gulf. The balance of the quantities leads to a Caspian Sea level change (ΔL). When these quantities are expressed in centimeters, the values are as follows:

R = 77 cm;
P = 19 cm;
G = 1 to 18 cm;
E = 97 cm; and
Kara Bogaz Gol = 3 cm.

Golitsyn (1995) broke down the components of the hydrologic budget in terms of annual contributions to change in Caspian Sea level: runoff (+75 cm), precipitation (+20 cm), evaporation (-96 cm), Kara Bogaz Gol (-1.5 cm). River withdrawals are shown to have effectively reduced the annual rate of Caspian Sea level rise by (-11 cm). The system of reservoirs on the Volga has matured to the point that its effect on the Caspian Sea level has stabilized. Seasonal variations in the Caspian Sea level are on the order of 40 cm within each year. Golitsyn discounted both the paleoreconstruction of the Caspian Sea level levels and the

assertion that neotectonics plays a role in Caspian Sea level fluctuations. It was suggested that watershed analyses (snow depth) would be a significant parameter for estimated near-future (within a year) Caspian Sea level levels. The Caspian Sea level is presently forecasted using Volga watershed snow level for periods up to 1 year, with accuracy of about 5 cm. Golitsyn also suggested that analysis of long tidal record is cumbersome, and that satellite images (TOPEX/POSEIDON, for example) is a more ideal way to analyze Caspian Sea level data. The using of stochastic modeling for Caspian Sea level forecasting is discounted, because much of this type of modeling is theoretical, bound by the assumption that the process (Caspian Sea level variation) is stationary, that is, that long-term trends have been removed. Because this stationary assumption is violated, stochastic model forecasts, such as that of Meshkani and Meshkani (1997), are called into question.

Erosion Related to Caspian Sea Level Rise

Ignatov et al. (1993) discussed the role of Caspian Sea level rise on the rate of coastal erosion. In the Caspian, the effects of sea level rise and the changing sediment loads from river sources have complicated the analysis. The system of

dams on the rivers leading to the Caspian Sea has significantly reduced the sediment load. The Caspian Sea level rise has led to further erosion of river deltas. The effect of the Caspian Sea level rise is discussed and categorized according the bed slope of the coastal regions along the shore of the Caspian Sea.

Klige and Myagkov (1992) stated that 79% of the water input to the Caspian is from runoff from 130 rivers; 20% is from direct precipitation; and the remaining balance of input is from groundwater contributions. Most of the water loss (97%) from the Caspian Sea is from evaporation, and the remaining 3% goes to discharge into the Kara Bogaz Gol Gulf. Historically, changes in the water budget are attributed to large-scale nonanthropogenic climatic changes leading to fluctuations in runoff and evaporation. However, they concluded that global warming, whether natural or anthropogenically triggered, will affect the Caspian Sea level to a degree that is comparable to those seen historically.

River Inputs

The Volga River is the source of nearly 80% of the riverine input into the Caspian Sea; there are many other minor rivers that flow into the Caspian.

Consequences of Caspian Sea Level Rise

The rise of the Caspian Sea level in 1977 has led to the inundation of coastal regions that had been built upon during the period from 1927 to 1977 (a falling Caspian Sea level period). This has had obvious negative impact on the coastal development, as alluded to by many authors (Shilo 1990; Meshkani and Meshkani 1997; Vaziri 1997; Cazenave et al. 1997). The inundation of the coastal regions has had an impact on transportation, industry, and tourism to the Caspian Sea coastal region (Shayegan and Badakhshan 1996).

Shayegan and Badakhshan (1996) indicated that the devastating effect (within Iran) of the Caspian Sea level rise did not occur until 1986. They described three categories of losses: a) financial, b) land and agricultural, and c) human and physiological. The quantification of the first two types of losses is relatively well documented; however, it has been difficult to quantify the human and physiological effects.

Financial losses include the 10,000 homes that have been damaged or destroyed, infrastructure losses (including water and power installations, port facilities, and fisheries institutions). The total financial

losses were estimated to be 1500 billion rials (about \$US1 billion). The construction of housing and institutions, and the installation of water barriers is estimated to cost about 30 billion rials (about \$US2 billion).

The land and agricultural losses amount to 20,000 ha of land, damaging wells, orchards, and fisheries, and causing infrastructure losses. Soil salinization is among the negative impacts of flooding related to Caspian Sea level rise (Kaplin 1995).

A positive impact has been expressed for fisheries, probably due to increased freshwater flow into the Caspian Sea and the consequent increased area of suitable spawning grounds (Kaplin 1995). Nonetheless, the quality of fresh water introduced into the Caspian Sea is noted to be poor, due to the discharge of sewage containing petroleum, phenols, copper, zinc and pesticides. Whether the Caspian Sea level rise has had an effect on the damage due to contaminant-loading is not documented. Kaplin (1995) stated that if the Caspian Sea level were to rise to -25 m, the loss of land within Russia would be 600,000 ha, and the loss of land within Kazakhstan would be 800,000 ha. Damage to oil and gas facilities that were not designed to be inundated is noted to be a significant



Figure 12 Kara Bogaz Gol Gulf (satellite photograph NM21-724-027 NASA)

negative impact to Caspian Sea level rise. Other industries that are negatively affected by Caspian Sea level rise include salt mining, transportation, tourism, and recreation. A cascade of other industries, such as the timber industry, are negatively affected by a disruption in the transportation facilities. Improved regulation of the dam that separates Kara Bogaz Gol Gulf from the rest of the sea has been suggested as a mitigation of the Caspian Sea level fluctuation in the future (Rychaogov 1997).

Water Quality

Overview

The most technologically developed areas of the Caspian

Sea region, including Central Russia, the Urals, Azerbaijan, Kazakhstan, and Turkmenistan, have had the greatest impact on the water quality of the sea (Efendieva and Dzhafarov 1993). Anthropogenic effects are evident in the river deltas and in ecologically sensitive areas of the sea, including the Kara Bogaz Gol Gulf (Figure 12), Baku Bay, and the coastal waters near Sumgait (Efendieva and Dzhafarov 1993). Increased urbanization, industrialization, and harvesting of natural resources have led to particularly heavy impacts in the northern region of the Caspian Sea (Efendieva and Dzhafarov 1993). Based on hydrochemical measurements, the Northern Caspian sea is

classified as moderately polluted and the waters near the Ural Borozdina are polluted (Bukharitsin and Luneva 1994).

Land-Based Pollution Sources

The major land-based sources of pollution to the Caspian Sea enter the sea via industrial and domestic wastewater (Efendieva and Dzhafarov 1993). The chemical industry of the Caspian includes a major complex in Azerbaijan, gas and gas-condensing plants in Astrakhan, the petroleum-and-gas works in Kazakhstan, and the salt-mining industry in the Kara Bogaz Gol Gulf (Kaplin 1995). Waste water entering the sea includes warm water from power stations (such as the nuclear reactor at Aqtau), water from desalinating facilities, treated and untreated water from domestic and industrial factories, contaminated sludge, and runoff from industry and agriculture, including animal wastes.

Inappropriate use of land-based fertilizers, pesticides, and herbicides has likely led to contamination of food and water supply and to human exposures. Genetic mutation

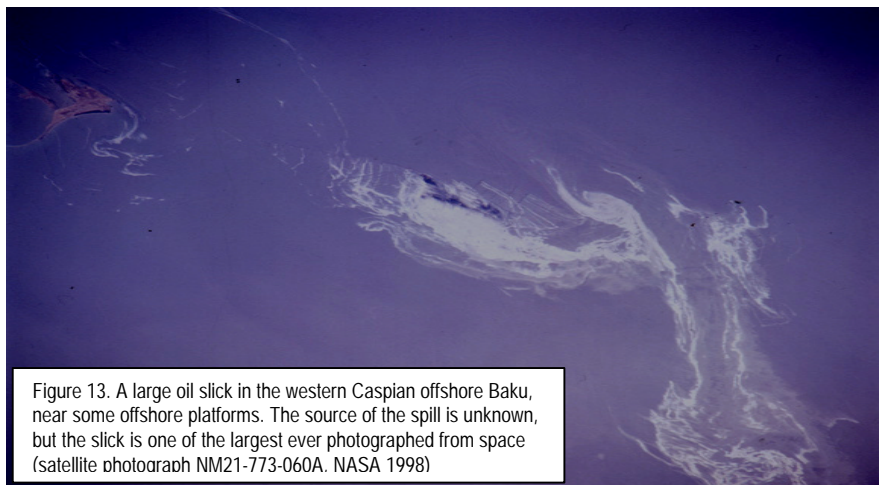
and cancers are among the resulting ecosystem and human health concerns. The need for wood as a fuel has resulted in soil erosion and associated water pollution.

Offshore Pollution Sources

Leakage of oil from offshore oil production is a major source of Caspian Sea pollution (Karpinsky 1992). In some areas, oil sheens have covered the sea surface (Figure 13), and lumps of oil were present on the bottom sediments near the Apsheron Peninsula (Baku) and on the western side of the southern Caspian.

Water Supply

The rise in sea level can result in entry of salt water to the water table. In general, domestic water delivery systems are unreliable and poorly maintained, and often include rusty pipes and reservoirs of disease vectors. Because landfills are generally unregulated and poorly maintained, leachates can enter the groundwater. Many wastewater treatment plants are outdated and inadequate.



Radionuclide Contamination

The inundation resulting from sea level rise may cause washout of residual radionuclide contamination in regions where Soviet underground peaceful nuclear explosions (PNEs) took place. In addition, there could be potential for leakage from sites of past uranium mining and milling, nuclear waste dump-

and burial sites, and reactor operations in the region.

Russia and Kazakhstan

Wastewater entering the Volga River contains pollutants such as heavy metals, pesticides, oil, surfactants, and phenols. More than 23 km³ of wastewater and industrial wastes containing 387,000 mt of suspended solids enters the Volga River per year

Table 2. Discharge of Pollutants to the Caspian by the Volga Runoff^a

| Pollutant | 1986 | 1987 | 1988 | 1989 | 1990 | units |
|-----------------------|-----------------|------|-------|------|-------|-------------|
| Petroleum products | 94 | 124 | 158 | 62 | 146 | thousand mt |
| Phenols | 635 | 1150 | 158 | 62 | 146 | mt |
| Active surface subst. | 3000 | 2900 | 2800 | 2790 | 3420 | mt |
| Suspended particles | NA ^b | NA | 17.62 | NA | 17.62 | mt |
| Pesticides | 74 | 0.96 | 0.78 | 1.51 | 30.5 | mt |
| Copper | 2700 | 1200 | 1060 | 863 | 11 | mt |
| Zinc | NA | NA | NA | NA | 1630 | mt |

a) TES 1992, cited in Kaplin 1995.

b) NA Not available.

Table 3. Characteristics of Surface and Sea Water Quality^a

| Index | MPC ^b mg/L | High Pollution | | Extremely High Pollution | |
|-----------------------|--------------------------|----------------|-----|--------------------------|-----|
| | | mg/L | MPC | mg/L | MPC |
| Oil Products | 0.05 | 1.05 | 30 | 5.00 | 100 |
| Phenols | 0.001 | 0.030 | 30 | 0.100 | 100 |
| Synthetic Surfactants | 0.1 | 1.00 | 10 | 10.00 | 100 |
| Ammonium Nitrogen | 0.39 | 3.90 | 10 | NA ^c | NA |
| Nitrite Nitrogen | 0.02 | 0.20 | 10 | NA | NA |
| Nitrate Nitrogen | 9.10 | 91.0 | 10 | NA | NA |
| DO ^d | NA | 3.0 | NA | 2.0 | NA |
| BOD ^e | 3.0 | 15.0 | 5 | 60.0 | 20 |

a) Bukharitsin and Luneva 1994.

b) MPC Maximum permissible concentration.

c) NA Not available.

d) DO - Dissolved Oxygen.

e) BOD - Biological Oxygen Demand.

(Bukharitsin and Luneva 1994; Kaplin 1995) (Table 2). The Volga received 600 mt of pesticides and 300 Mmt of solid wastes in 1992 (Efendieva and Dzhafarov 1993). Approximately 120 Mm³ of sewage enters the Volga each year, 85% of which comes from agriculture and processing activities (Kaplin 1995). The anthropogenic load from the Astrakhan region is high on the Pyramaya Bolda Arm of the Volga (Bukharitsin and Luneva 1994).

Recent increases in high-tonnage shipping and the creation of port facilities have added to the pollution load of major Russian rivers. Industrial discharge from Volgograd contains petroleum, sulfate, and phenol wastes, and

area agriculture has used 100 types of pesticides, including DDT and hexochlorane (Voropaev et al. 1992). Synthetic surfactants enter the waste stream from industrial, domestic, and agricultural wastewater, and from the cleaning of oil transport vessels. The highest surfactant concentrations (0.11 mg l⁻¹) have been observed near the mouth of the Volga River (Bukharitsin and Luneva 1994). Bukharitsin and Luneva (1994) classified the water of the lower Volga as moderately polluted, polluted, or extremely polluted (Table 3).

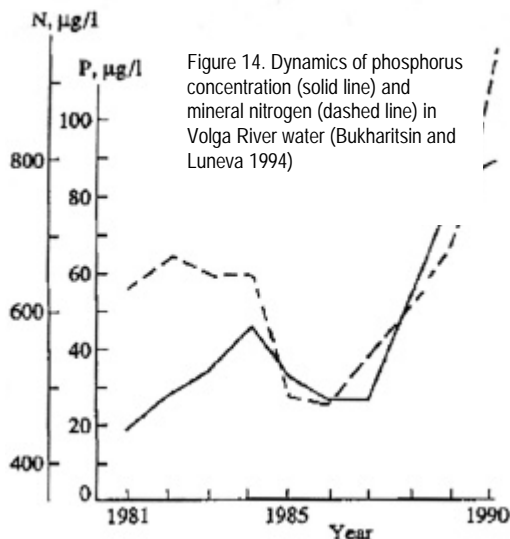
In 1996, changes were observed in the morphology of juvenile frogs collected near a chemical weapons factory and a chemical

fertilizer factory on the middle Volga (Chubinishvili 1996). The highest incidence of developmental abnormalities occurred in frogs collected at the site of the wastewater discharge from the chemical fertilizer manufacturing plant.

A toxicological study used water samples collected near municipal and industrial wastewater discharge sites on the Volga for acute and chronic laboratory toxicity test using guppies and daphnia (Flerov et al. 1996). The water collected from a residential area discharge site was acutely toxic year-round, requiring as much as a tenfold dilution to stop the acute toxicity. The water from an industrial site was acutely toxic for 9 months of the year, requiring as much as a hundred-fold dilution to eliminate the acute toxicity. These studies stress the need to modernize private and public wastewater treatment plants to handle the increasing volume of waste.

Northern Caspian

The anthropogenic load from the Astrakhan region is high on the Pyramaya Bolda Arm of the Volga. The waters of the northern Caspian are classified as moderately polluted, and those near the Ural Borozdina, as polluted (Bukharitsin and Luneva 1994).



Nonetheless, the pollution of the surface waters has been steadily decreasing for most pollutants in recent years, with the exception of nitrogen and phosphorous, which have increased significantly (Figure 14).

The average annual oil pollution in the northern Caspian seawater increased from 0.007 to 0.21mg l⁻¹ from 1985 to 1990 (Bukharitsin and Luneva 1994). Maximum pollution was detected from the Mangyshlak Ledge and in the sea near the mouth of the Volga River. Bukharitsin and Luneva (1994) concluded that nearshore petroleum industry increases water pollution and degrades the ecosystem, and that it is aggravated by sea-level rise often accompanied by wind-surges, especially in the northeastern part of the sea.

The authors projected severe negative impacts from further development of the oil industry in the northern Caspian area. In addition to oil production and transportation, natural oil seeps from mud volcanoes on the sea floor contribute to the levels of oil found in the water and the seabed of the Caspian (Ireland 1994).

The Volga and the Ural Rivers (Kaplin 1995) carry large amounts of plant nutrients into the Northern Caspian. The wastewater entering the Volga contains nitrogen and phosphorous compounds; these organics contribute an anthropogenic portion that can be 70% of the total load (Bukharitsin and Luneva 1994). The organic matter input to the northern Caspian increased from 3.5 to 6-7 million mt since the early 1980s. The concentration of ammonium nitrogen in the lower Volga increased to 204 mg/L in 1990 (Figure 14). The concentration of phosphorous in the northern Caspian is similar to those found in the Volga River discharge waters. Nitrates and nitrites are in greater concentration near the river discharges in the western sea than in discharges from the east. The amount of total nitrogen in the northern waters has increased steadily since 1970 due to the input of organic nitrogen into the sea. This input has resulted in increased

eutrophication in Volga delta and northern Caspian waters.

The oxygen levels in the northern Caspian Sea area during the late 1980s were considered reasonable and averaged 10mg/L during 1987 through 1990 (Bukharitsin and Luneva 1994). However, with the recent rise of the Caspian Sea level, an increasing amount of organic matter is entering the sea from the Volga River delta. Large areas of oxygen depletion occur that are two times larger than before the Volga waterway was altered in the late 1950s and penetrate to depths of 10 m. The change in oxygen levels affects the ecosystems and can be observed by changes in the frequency and duration of algal blooms, benthic dieoffs, fish kills, and changes in fish distribution.

The dissolved oxygen content of the seawater is a significant indicator of hydrochemical conditions (Kaplin 1995). The dams on the Kura and the Volga diminish flows and create areas below the hydrostations with increased temperatures and low dissolved oxygen (Efendieva and Dzhafarov 1993). In the Northern Caspian, oxygen levels range from 4.9 to 10.6 mL/L. The oxygen content in the seawater below 400m is 1 mL/L higher than in the waters above 400 m. The mixing caused by the inflow of Volga River waters can

increase the dissolved oxygen from 1% to 9%, but the dams and irrigation have significantly diminished the water flowing into the sea.

The pH levels of the Caspian Sea are generally higher than those of other marine basins, due to the alkaline river inflows and average 8.3 to 8.6 in the surface layer and 7.8 to 8.0 in the deep layer. The pH of the surface waters has been increasing in the last several decades, indicating increased photosynthesis. Following the increased river input and the rising sea level since the late 1970s, the trend in water conditions has been generally favorable ecologically; salinity is down, and inorganic phosphorous has increased, whereas silicon content is down, indicating increased phytoplankton biomass. Heavy metals can be the most hazardous pollutants due their persistence and biaccumulation in the ecosystem (Bukharitsin and Luneva 1994). The metal pollutants are suspended in the waters of the Volga River delta in various forms, organic or inorganic, and hydrological processes govern their associated toxicity. Field studies conducted from 1985 to 1990 found considerable water pollution and zinc and copper exceeded maximum allowable limits at many northern Caspian Sea sites. The major sources of copper and zinc

pollution in northern Caspian and the Volga delta area are industrial and agricultural wastewater. The copper in the Volga River water increased 11.5 times (7.0 μ L/L), zinc 9.8 times (22.5 μ L/L), lead 5.6 times (1.3 μ L/L), cadmium 4.9 times (0.5 μ L/L) after the late 1980s.

In riverbed sediments from the Volga delta, concentrations of metals decreased from 1982 to 1988. Iron, manganese, nickel, copper, and vanadium decreased by 1.4, 1.5, 1.7, 1.8, 2.4, and 3.8 times respectively (Mumzhu et al. 1991). In areas of industrial development, metal concentrations increased during the late 1980s.

Azerbaijan

The main sources of water contamination in Azerbaijan are industry, agriculture, cities, energy production, and recreation. Azerbaijan discharged more than 300 million m³ of treated wastewater and more than 500 million m³ of polluted wastewater into the Caspian Sea in 1992. This wastewater included more than 3000 mt of petroleum products, 28,000 mt of suspended substances, 74,000 mt of sulfates, 315,000 mt of chlorides, 25 mt of phenols (Efendieva and Dzhaifarov 1993). Azerbaijan has an aging urban infrastructure with unreliable power, water, and

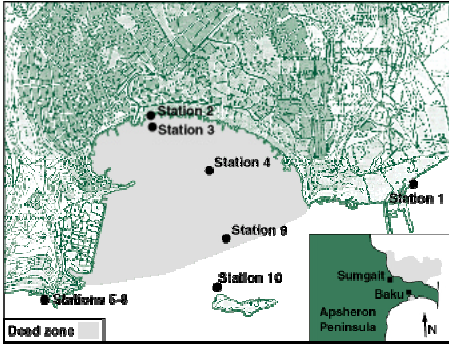


Figure 15. Locations of sediment sampling stations in and around Baku Harbor; dead zones in the harbor and on the north shore of the peninsula are shaded gray (Rowe 1996)

sewage services. Extensive coastal flooding is occurring due to sea level rise (Bickham 1996).

Local Azerbaijani scientists classified the Apsheron Peninsula and the Caspian Sea to be the “ecologically most devastated area in the world because of severe air, water, and soil pollution” (CIA 1997a; EIA 1997a). The water supply in Baku is unreliable, with problems such as turbidity, higher organics and bacteria content, 50%-60% loss to leaks in the system, and outbreaks of cholera and hepatitis (Blair 1994).

The area surrounding Baku is littered with old wooden derricks surrounded by pools of oil left as a result of poor oil extraction techniques and lack of maintenance; these are slowly being swallowed by the rising sea (Dumont 1995).

Large, lifeless areas of the seabed, called “dead zones,” are alleged to be present in the coastal waters near Baku Bay and Sumgait (Figure 15) (Rowe 1996). In Baku Bay, the bottom sediments are contaminated with approximately 200 million mt of petroleum hydrocarbons, phenols, heavy metals, alkalis, and other toxic substances to a depth of 10 m to 12 m (Efendieva and Dzharov

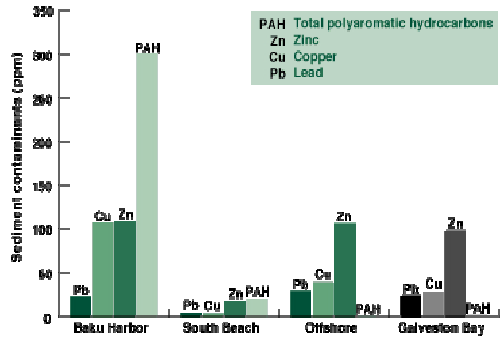


Figure 16. Concentrations of trace metals and PAHs in representative samples of sediment (Bickham 1996)

1993). Total hydrocarbon polycyclic aromatic hydrocarbons (PAHs), known carcinogens, were found in the harbor sediments approximately 10 times above the maximum values reported in the U.S. status and trends data (Figure 16) (Rowe 1996). Forty percent mortality was observed in larval and fingerling sturgeon (*Acipenser gueldenstaedti*) exposed to 2.4 ppt of sediment collected from Baku harbor (Figure 17) (Bickham 1996).² Further,

survivors of the sediment-exposure test revealed increased chromosomal breakage in their blood cells, which could affect the health and condition of the sturgeon and reduce their reproductive potential (Bickham 1996). Although wastewater treatment plants in Azerbaijan were upgraded in the early 1990s, they have not been able to keep up with increasing demands.

Baku Bay has received as much as 800 million m³/year of industrial and domestic wastewater, and the dead zone in Baku Bay inhibits natural remediation of pollutants (Efendieva and Dzhafarov 1993; Bickham 1996).

Historically, Sumgait contained as much as 80% of the Industrial chemical manufacturing capacity of the FSU (Bickham 1996).¹ Although the industry operated at 15% of its capacity in 1996, the large amounts of historical waste are reportedly releasing pollution into the Caspian Sea over time. The coastal waters of Sumgait receive approximately 400,000 m³ of domestic and industrial

¹ Although a direct link between the environmental pollution has not been demonstrated in the city of Sumgait on the Aspheron peninsula in Azerbaijan, cemeteries with hundreds of children's graves usually marked by portraits of deformity and retardation, high rates of miscarriages, still births, birth defects, and mortality during the first year of life are reported by the ecological advisor to Sumgait's Mayor (Islamzade 1994).

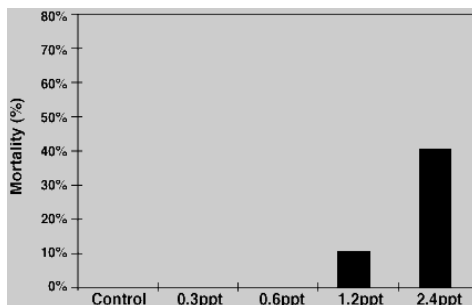


Figure 17. Mortality rates of sturgeon fingerlings (*Acipenser gueldenstaedti*) exposed to 1.2 to 2.4 ppt of sediment from Station 2 in Baku Harbor (see Figure 15) (Bickham 1996)

wastewater per year (Efendieva and Dzhafarov 1993).

The Kura is the largest river in Azerbaijan; it is polluted by agriculture in Azerbaijan and the mining industry and carries heavy metal pollution, including copper and molybdenum, originating in Georgia and Armenia (Dumont 1995; Bickham 1996). In 1988, 11 mt of fuel oil was accidentally released into the Kura and severely polluted the river for 200 km (Efendieva and Dzhafarov 1993). The portion of the Caspian Sea basin that lies in Georgia includes 29 rivers, 4 lakes and 3 reservoirs (Georgian Geoinformation Centre 1996). One of the rivers in the Caspian Sea watershed is the second largest river in Georgia, the Mtkvari. It is classified as is highly polluted, after it drains 23% of the country (15,000 km²) before it flows through Azerbaijan on its way to the Caspian Sea. The city of Tbilisi contributes organic pollution to the Mtkvari, which exceeded

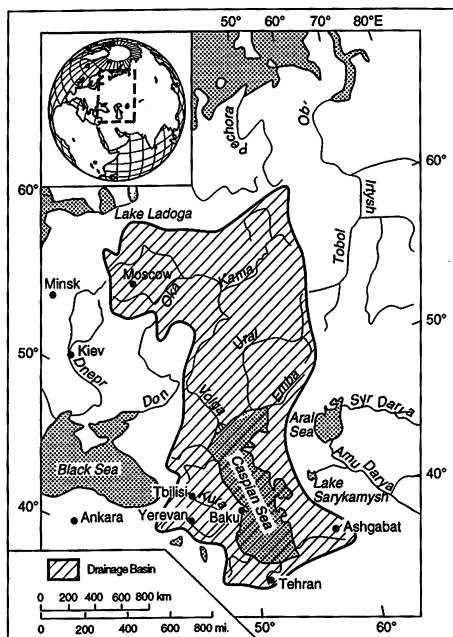


Figure 18. The Caspian basin (after Rodionov 1994)

maximum permissible limits by 1.5 times, phenols by 11 times, and nitrous ammonia by 4 times. The metallurgical, cement and Azoti factories of Rustavi contribute organic substances that exceed limits by 1.5 times and phenols by 12. Deforestation is one of the major ecological problems in Azerbaijan that has led to erosion effects on water quality, among other impacts (Turyalay and Hajiyevev 1994).

Iran

The major water quality issues facing Iran are related to deforestation, water and air

pollution, and shortages of potable water (CIA 1997b; EIA 1998). The rivers of the Guilan Province of Iran receive discharge from solid waste dumpsites, 75% of which are located near or along rivers and 13% of which are sited on the shores of the Caspian (Abduli 1997). Hundreds of tons of solid and semisolid waste are dumped in rivers and surface waters every day in the province, and dumping at landfill sites is largely unmanaged and uncontrolled; 45 large-scale industries in Guilan dump their solid wastes at one landfill that is located 550 m from the Kacha River. Pourang (1995) examined the levels of heavy metals in fish tissues collected in 1993 from the Anzali wetland in Northern Iran. They found levels of copper in the muscle tissue to average 1.3 ppm vs. 0.6 ppm in the average of 11 commercially important freshwater Caspian Sea species but well below human health limits of 70 ppm, which is 5000 to 12,000 times greater than water concentrations. Lead concentrations in the Caspian Sea species averaged 1.7 ppm, and the estuarian species average ranged from 1.2 to 1.4 ppm below the 2.5 ppm recommended for human consumption by the Iranian Standard Bureau.

Turkmenistan

Agriculture is the leading cause of environmental damage in Turkmenistan (EIA 1997e; CIA 1997e). Poor irrigation techniques have resulted in soil saturation, salinization, desertification, and depletion of the Amu Darya River. Soil and groundwater are polluted with agricultural chemicals and pesticides. Turkmenistan is extending the Karakumski Canal, thereby allowing pesticide contaminated drainage water to enter the Caspian (Dumont 1995).

Nuclear Setting

In the Caspian Sea region of Central Asia, there are several nuclear reactors used for power production and research, and many nuclear sites remaining from activity of the FSU, including those of uranium mining and production, nuclear waste dumping, storage, fuel production, and PNEs. The Caspian basin (Figure 18) includes all of the sites north and beyond Moscow to the headwaters of the Volga River, the to the west to the source of each of the major river systems, the Kama, Ural and Emba, and the Kura to the east of the sea. However, for the purposes of this study, only those within the immediate Caspian Sea region are described in detail because of their direct potential impact to the sea and to the



Figure 19. Nuclear power and research reactor sites in the Caspian Sea vicinity. Reactors at Novovoronezh , Russia, Madzamor, Armenia, and Aqtou, Kazakhstan are online for power production; those at Tehran and Esfahan are for research.

region's vulnerability to transnational conflict (B. Shaw, personal communication, June 1998; D.J. Bradley, personal communication, June 1998).

There are allegations made in the news and public information media about radionuclide contamination in the Caspian Sea (e.g., CIA 1997a, 1997c, 1997d; Greenwomen Environmental Information Agency 1997; Sievers and Aranbaev June 1997), but there is neither direct evidence pointing to specific source terms, nor any complete measures of contamination that has

Responding to Environmental Challenges in Central Asia and the Caspian Basin

Table 4. Nuclear Reactors in the Caspian Sea Vicinity

| Country | Location | Reactor | Purpose | Reference |
|------------|---------------------------|-------------------------------------------------------------------------------------------------------|-------------|-------------------------|
| Armenia | Madzamor (Yerevan) | PWR ^a | Electricity | INSC 1997 |
| Iran | Tehran | Unknown | Research | EIA 1998; INSC 1998a |
| | Esfahan | ENTC GSCR ^b ENTC HWZPR ^c ENTC LWSCR ^d ENTC TRR ^e | Research | INSC 1998a |
| Kazakhstan | Aqtau | LMFBR ^f (BN-350) | Electricity | INSC 1998b |
| Russia | Novovoronezh (Volgadonsk) | PWR (7 units) | Electricity | PNL 1998a |
| | | VVER ^h (210 through 1000) | | INSC 1998e |
| | Rostov (Volgadonsk) | PWR VVER (4 units) | Electricity | INSC 1998g |
| | Balakovo | PWR (4 units) VVER-1000 | Electricity | PNL 1998b INSC 1998f |
| | Dmitrovgrad | BWR ⁱ (4 units) | Research | INSC 1998c |

a) PWR pressurized water reactor.

b) ENTC GSCR subcritical water reactor.

c) HWZPR tank-in-pool heavy water reactor.

d) LWSCR subcritical light water reactor.

e) TRR pool water reactor.

f) LMFBR liquid metal cooled fast breeder reactor.

g) EWG-1 tank-type water- and gas-cooled reactor.

h) VVER is a Soviet-designed PWR, in Russian called Vodo-Vodyanoi Energeticheskii Reaktor.

i) BWR boiling water reactor; at Dmitrovgrad, there are four different research BWRs: MIR-M1 (channels and pool); RBT-10/1 (pool); RBT-10/2 RBT-6 (pool); SM-2 (tank).

reportedly entered the sea (D.J. Bradley, personal communication, June 1998). TED (1997b; 1997c) gave no quantification, but reported that radioactive sediment from the Chernobyl accident of 1986 has reached the Caspian Sea by way of the Volga River and canal systems.

Reactors

Figure 19 and Table 4 indicate the sites of nuclear reactors for the production of power in the vicinity of the Caspian Sea, sited at Novovoronezh (Volgadonsk) (Figure 20), Balakovo (Figure 21), and



Figure 20. Reactor at Novovoronezh Volgodonsk), Russia (PNL 1998a)

Rostov in Russia, at Aqtai in Kazakhstan (Figure 22), and at Yerevan in Armenia (PNL 1998a, 1998b; INSC 1997, 1998b, 1998c, 1998g). Reactors for research are found at Tehran and Esfahan, Iran, and Dmitrovgrad, Russia (EIA 1998; INSC 1998a, 1998c). Others outside the immediate Caspian Sea area that could potentially

have an impact to the sea, for example, via the Volga watershed, are probably at low risk of doing so (D.J. Bradley, personal communication, June 1998). Nonetheless, a recent report from the Bellona Institute (Kudrik 1997) reported accidental discharge of radioactivity to the atmosphere at the Dimitrovgrad Research Institute on the Volga River July 25-26, 1997. Discharge levels of ^{131}I were about 18 times above the normal levels (2.2 to 2.6 GBq for two days, 1.9 to 2.2 GBq for 5 days, above the regular levels of 122 MBq/day) for about one week (Kudrik 1997).

²Iran's reactor for production of electrical power is located at Bushehr, in the south of the country. The 1300-MW pressurized light water unit and modern VVER-440 units should be fully operational by 2000. The head of Iran's Atomic Energy Agency announced in October 1997 that Iran would pursue a plan of meeting 20% of the country's electricity needs through nuclear power (EIA 1998). As recently as February 1998, the U.S. State Department reaffirmed U.S. opposition to Iran's nuclear program on the grounds of Iran's abundant oil and gas reserves for power generation, the expense and lack of need for nuclear reactors, and that materials from reactors could be used for military purposes (EIA 1998).

Berkeliev (1997) expressed concern that the nuclear energy station at Aqtai is problematic in light of the rising level of the



Figure 21. Reactors at Balakovo, Russia (PNL 1998b)

Caspian Sea: water is not only currently closer to the reactor, he alleged, but also the groundwater has risen, and the sea is now physically connected to the reactor's cooling pond. *Nuclear Fuel Cycle and Nuclear Wastes*

activities include past and present uranium mining and milling operations, uranium conversion, enrichment and fuel fabrication, irradiation in nuclear reactors, and storage of wastes from every step in the cycle (Bradley 1997).

All phases of the nuclear fuel cycle, along with weapons testing, accidents, deliberate discharge of wastes, and disposal of industrial, medical, and research wastes could potentially contribute to radionuclide contamination of the Caspian Sea. Nuclear fuel cycle



Figure 22. Reactors at Aqtou, Kazakhstan

Responding to Environmental Challenges in Central Asia and the Caspian Basin

The major problems related to waste management that are reported for Russia, but which would likely apply to the other republics of the FSU as well, are as follows: large quantities of existing and newly generated radioactive wastes remain untreated; a lack of facilities for safe handling of radioactive

waste and spent nuclear fuel; facilities that are not considered safe, do not meet current environmental requirements, and/or are filled to capacity. These problems increase the risk of radioactive contamination of the environment and for radiation accidents (Bradley 1997).

Table 5. Nuclear Fuel Processing Facilities, Radons,^a and Other Potential Sources of Radioactive Pollution in the Caspian Sea

| COUNTRY | LOCATION | FACILITY | FACILITY TYPE | REFERENCE |
|--------------|----------------------------------------------------|----------------------------------|--------------------------------------|-----------------------------|
| Armenia | Yerevan | Radon ^a | Radioactive waste storage | Bradley 1997 |
| Azerbaijan | Baku | Radon | Radioactive waste storage site | IAEA 1995 (in Bradley 1997) |
| Kazakhstan | Mangyshlak | Uranium strip mine | Uranium processing | Berkeliev 1997 |
| | Mangyshlak | Underground nuclear test site | Peaceful nuclear explosions (three) | Bradley 1997 |
| | Aqtau | Kaskor uranium mill | Uranium tailings | Bradley 1997 |
| | Plato Ustjurt | Underground nuclear blast site | Peaceful nuclear explosion | Bradley 1997 |
| | Sarykamys area | Underground nuclear blast site | Peaceful nuclear explosion | Bradley 1997 |
| | North shore Caspian near Kazakhstan western border | Underground nuclear blast site | Peaceful nuclear explosions (series) | Bradley 1997 |
| Russia | Novovoronezh, Volgadonsk | Novovoronezh Reactor site | Spent fuel storage | INSC 1998d |
| | Lermontov | Uranium mine | Uranium mine | Bradley 1997 |
| | Volgograd and Samara on the Volga River | Radon | Radioactive waste storage site | Bradley 1997 |
| | Dmitrovgrad | Dmitrovgrad Research Institute | Radioactive waste injection | Bradley 1997 |
| | | | Accidental discharge | Kudrik 1997 |
| Turkmenistan | Cheleken | Cheleken Chemical Factory | Industry using activated charcoal | Berkeliev 1997 |
| | Nebit Dag | Nebit Dag Iodine-Bromide Factory | Industry using activated charcoal | Berkeliev 1997 |
| | Kizilkaya | Gyusha transfer station | Uranium mining, transfer | Berkeliev 1997 |
| | Karakumskij Canal, Ashkabad | | Radioactive waste storage site | Bradley 1997 |
| Uzbekistan | Kyzylkum near Kazakhstan border | Underground nuclear blast site | Peaceful nuclear explosion | Berkeliev 1997 |

a) Radon is a regional radioactive waste storage site in the FSU republics.

Although sites of nuclear activity are not as concentrated in the Caspian Sea region as in some other areas of the FSU, there are nonetheless a number of sites of potential concern. Near the Caspian Sea, Armenia, Azerbaijan, Russia, and Turkmenistan all contain regional radioactive material storage sites, called *radons*. For example, the radon at Baku, Azerbaijan, on the shore of the Caspian, does not treat wastes, but stores up to 25 m³/year of solid and liquid radioactive waste materials. The radon facility at Yerevan, Armenia, stores up to 5 m³/year of solid, liquid, and biological radioactive wastes, and spent ionizing radiation sources. Rivers of northeast Azerbaijan flow directly into the mid-Caspian Sea; rivers of southeast Azerbaijan, the major one of which originates in Armenia and drains the Yerevan area, flow directly to the south Caspian. Therefore, any radioactive wastes carried from mining or former processing sites in these areas would also potentially be carried to the sea (ENRIN 1997b). Further, former uranium mining and processing sites and sites of PNEs are in the region of the Caspian and could pose risk for release of radioactive materials into the waterways that lead to the sea (Table 5). A detailed description and inventory of radioactive residues and wastes resulting from the FSU nuclear

activities in this region can be found in Bradley (1997).

On the Turkmenistan coast of the Caspian, two chemical factories that use activated charcoal in their industrial processes have released radioactive wastes onsite at Cheleken Chemical Factory and Nebit Dag Iodine-Bromide Factory (Table 5). The total radioactive pollution at the former site has been monitored at 200,000 Bq/kg (average 80,000 Bq/kg) of wastes, in a total of 15,000 to 18,000 mt of wastes that are accumulated around the factory (Berkeliev 1997), which would equal a total maximum activity of about 40 Ci (D. Bradley, personal communication). There are also deposits of radiobarites in old wells drilled for oil, gas, and industrial salts at Cheleken, the total radioactivity of which was estimated at 10 million Bq (.0003 Ci) in 1966 (Berkeliev 1997).

Although detailed information is not available, it is strongly suspected that PNEs were carried out for industrial purposes at least once in 1972 in the Mary Region of Turkmenistan to seal a gushing petroleum well, and similar PNEs were carried out in the Ustjurt and the Kyzylkum of Kazakhstan near the Turkmenistan border (Berkeliev 1997; Bradley 1997; Table 5).

Fisheries

Background

As the world's largest low-salinity lake, or enclosed inland sea, the Caspian presents a unique environment, and thus a unique fisheries complex. Seasonal thermocline in the Caspian Sea limits the influence of surface temperature fluctuations on benthic communities and bottom-feeding fish stocks such as sturgeon to the top 200 m in the north Caspian and to the top 100 m in the deeper south Caspian basins. The other unique environmental feature of the Caspian Sea that affects the fisheries is the long-term fluctuation in the water level. This phenomenon is discussed elsewhere in this paper, but it has been determined by Kaplin (1995) that the optimal level for fisheries production in the Caspian is -27 ± 1 m. With water heights above this level, valuable spawning grounds are submerged in the Volga delta, and flooding of previously dry, former oil-production areas on land could introduce industrial pollution into the sea (Figure 24). Below this level, at a level of -30 to -30.5 m, fish catches also decline, as occurred during the water level drop of the 1930-1977 period. Some estimates indicate the 1930-1977 drop was as much as 60%, although insufficient data exist to verify this number (Kaplin 1995).

The sea-level conditions along with the meteorological parameters characterize the Caspian Sea fisheries' physical environmental regime, and they are the major drivers for the life cycles, feeding, and migration patterns that represent the natural controls on the historical wild capture fisheries. Because of the north-south asymmetry in the seasonal temperature of the upper portion of the Caspian Sea, many species, particularly the sturgeon (*Acipenseridae*), kilka and dolginka (*Clupeonella* sp.), migrate to the north in summer to feed and to spawn, and south in the winter to the middle or southern basins. In the last decade, however, a significant effort to increase aquaculture production of sturgeon and shrimp has been initiated by Iran in the south Caspian Sea (Abbasian 1997). The environmental factors that affect aquaculture are similar to those that have impact on wild-capture fisheries, with the exception of small long-term changes in water level and other factors that might have an effect on primary and secondary productivity. Most aquaculture programs presume that feed will be provided, because of the high population density, and that feeding would be controlled for optimal growth of the stocks in culture. Thus, the major requirement for aquaculture is clean water with high dissolved oxygen levels to avoid stressing

the stocks in culture. A second requirement would be no toxic algal blooms, introduced parasitic organisms, or introduced organisms that might compete for available food sources in the pelagic, neritic, epibenthic or benthic communities; historically, none is indicated to exist in the Caspian Sea.

Caspian Sea Fisheries Resources

The Caspian Sea is favored by specific conditions that result in high productivity and a unique composition of ichthyofauna. The high productivity is the result of high levels of solar radiation, as a result of its latitude range. High insolation is combined with large inputs of nutrient salts carried by the rivers entering the sea, as well as with a large pool of nutrients and organic matter involved in the primary and secondary production cycles of the sea, the phytoplankton and zooplankton. This primary and secondary production then support dense populations of larger fish and mollusks. Vertical mixing of the waters of the sea driven by evaporation in summer and cooling in winter also cause the bathypelagic layers, with rich nutrient content, to rise to the surface. This action releases the nutrients from entrapment in the depths (Kaplin 1995). Finally, the low salinity of the

Caspian Sea has allowed the entry of many freshwater fish species to the basin to take advantage of this high productivity.

According to Kasymov (1990), there are 42 genera of fish (family Pisces) with 100-114 species, 13 genera of mollusks (family Mollusca) with 118 species, and 1 genus of mammals (family Mammalia) with 1 species among the fauna of the Caspian Sea. Of the total 219 species, 20 species (1 mammal and 19 fish) make up the majority of the fishery harvest in the Caspian Sea (Kaplin 1995). These include the Caspian seal (*Phoca caspica*); 4 species of sturgeon; 3 species of pike (*Esox lucius*, *Silurus glanis*, *Perca fluviatilis*); 3 species of Caspian shad (*Alosia caspia caspia*, *Alosia brashnikova*, *A. saposhnikova*), kilka, and dolginka; bream (*Abramis brama*); kutum (*Rutilus frisii*); and Caspian salmon (*Onchorynchus kheta*).

Although there are several smaller artisanal and commercial fisheries, such as crayfish and pike (*Esox lucius*), that can have local impacts, there are three fisheries with high economic profiles, and thus high sensitivity and potential for conflict. These are the sturgeon fisheries, the kilka fishery, and the herring/shad fishery. These fisheries could total 250,000 tons of sustained

annual production, determined by long-term management studies during the Soviet era (Kaplin 1995).

Historical Caspian Sea Fisheries

Prior to the breakup of the FSU, the fishery in the Caspian Sea was divided between the countries of Iran and the FSU. Extensive fisheries research was conducted by FSU from research centers in Astrakhan and Baku starting in 1904 and 1912, respectively (Karpinsky 1992). Catch records were well maintained and extensive, as was fisheries research for the Volga-North Caspian basin during this period (e.g., Kaplin 1995; Khodorevskaya et al. 1997) (Table 6).

After the breakup of the FSU, the fishery resource was divided among the five new states with shoreline on the Caspian Sea. This was done by common agreement in a letter of understanding between the five countries on February 18, 1992 but disputes as to mineral extraction rights tended to fall back on land claims under other treaty basis and have prevented any agreement on allowable catch limits (Kaplin 1995; Khodorevskaya et al. 1997; TED 1997b, 1998b). Allocation issues are moot, however, because the fishing fleets are obsolete and in poor repair. As an example, Turkmenistan is presently

unable to harvest or process the 50,000 mt allocation it claims (Hamlin 1998). Fishery protection under the FSU conditions was exercised through various Russian government and military offices, and Iran exercised its own control through Shilat, the Iranian state fisheries organization. Fishery protection in the present period is exercised through negotiation among the five countries and common agreement with enforcement within each sector under each nation's control. However, the existing enforcement is weak to nonexistent outside of Iran. Poaching, particularly of sturgeon, is a significant problem on the Volga and Ural Rivers in Russia and in the north Caspian Sea (Byalo 1997; Gritchin 1997).

Table 6. Total Catch of Sturgeon, Pike-Perch Bream, Wild Carp, and Roach in the Volga-Caspian Basin, 1946-1980^a

| PERIOD | TOTAL (thousands of mt) |
|-----------|----------------------------|
| 1946-1950 | 224 |
| 1951-1955 | 350 |
| 1956-1960 | 262 |
| 1961-1965 | 149 |
| 1966-1970 | 131 |
| 1971-1975 | 152 |
| 1976-1980 | 77 |

a) Data from TES 1992, cited in Kaplin 1995.

Sturgeon

Commercial sturgeon fishing and the caviar (sturgeon roe) trade in the Caspian Sea date to the reign of Peter the Great, who designated fifty royal fishermen to control the fishery in 1672. The Bolsheviks maintained the monopoly in 1917, and Russia and Iran limited the harvest until the breakup of the Soviet Union in 1991 (TED 1997b). The Caspian is recognized as the only body of water to support six different species of sturgeon (Efendieva and Dzhabarov 1993). However, there are only three commercial species of wild sturgeon in the North Caspian Sea, the beluga (*Huso huso*), stellate (*Acipenser stellatus*) and Russian (*A. gueldenstaedii*), and one in the south Caspian, the Persian sturgeon (*A. persicus*). Prior to 1951, commercial sturgeon fishing was performed in the open Caspian Sea with nets. At that time, it was recommended that the fishery be restricted to the delta and lower reaches of the Volga River, and net fishing was banned in the open sea (Khodorevskaya et al. 1997). Also starting in the 1960s, the Soviet Union released gradually increasing numbers of juvenile sturgeon, particularly the more desirable beluga sturgeon to supplant dwindling returns. The decreasing water level in the Caspian was held to blame, but dams on the Volga and other pollution and habitat

loses were given equal weight. Hatchery releases started at 4 million and ended at 80 million juvenile sturgeon annually in the late 1980s (Khodorevskaya et al. 1997).

Presently, the breakup of the Soviet Union, and financial strictures in Russia and the modern countries of Kazakhstan, Azerbaijan, and Turkmenistan have reduced the number of hatchery release levels to less than that necessary to sustain the fishery (Khodorevskaya et al. 1997). The presence of the extensive poaching and overharvest by the new countries of Kazakhstan and Azerbaijan have driven adult populations to dangerous lows, possibly near to extinction. Further, starting in 1984, pollution-induced stress was noted in all three commercial species of *Acipenseridae* (Voropaev et al. 1992; Efendieva and Dzhabarov 1993; Veshchev 1995; Khodorevskaya et al. 1997). The symptoms of muscle atrophy due to degeneration of the fibers of the striated muscle tissue seem to be related to diesel fuel and chlorinated hydrocarbons, and they result in nonviable embryos from the sturgeon eggs. High levels of pesticides and heavy metals in livers, gonads, and muscle of sturgeons, and the appearance of tumors in the tissues indicate that the effect of increasing levels of pollution in the

Caspian from the Volga and from shoreline industrial waste discharge will intensify in the near future in the north and mid-Caspian Sea (Khodoreveskaya et al. 1997; Akimova and Ruban 1996). At this time, all sturgeon species in the Caspian sea are listed as endangered by the Sturgeon Specialist Group and the International Union for the Conservation of Nature (IUCN) World Conservation Union (Sturgeon Specialist Group 1997).

There are some mitigating forces that balance the sturgeon problems in the north in the southern Caspian Basin. In 1989, Iran relaunched its caviar trade, shut down since 1979, because it was allegedly against Islamic law. Islamic fundamentalists in a reaction against the programs of the deposed Shah of Iran said sturgeon did not have scales, and thus were not *hala*, and therefore, acceptable under Islamic law. In 1982, a mullah in a coastal village determined that sturgeon actually do have scales, and after discussion by theologians of the religious body, *Qom*, determined that sturgeon and sturgeon products are acceptable under Islamic law. The late Imam Khomeini lead the country toward an expanded fisheries through the establishment of Shilat. With a research facility at Sari in the Caspian Sea province of

Mazandaran, Iran has had remarkable success in the aquaculture of beluga as well as other species of sturgeon (Abbasian 1997; TED 1998b).

On November 16, 1996, the five Caspian Sea countries signed an agreement to ban all sturgeon fishing in the Caspian Sea except in the deep channels of the Volga delta, with equal fishing rights for all of the FSU countries at this location (Khodoreveskaya et al. 1997). However, rampant poaching in the Volga delta and Caspian Sea by Kazakhstan and Azerbaijan, and the tacit involvement of the Russian government in 1997 led buyers more often to seek Iranian caviar. This trade is partly driven by the poor quality of some of the poached product, but more the control by Shilat of the entire Iranian production and distribution through reputable dealers of long standing. Further, Iran also processes and distributes Turkmenistan caviar, because that country lacks production facilities. Thus, a steady Caspian Sea caviar supply appears to be available independent of Kazakhstan, Azerbaijan, and Russia.

Total production for any one of the northern Caspian Sea countries is hard to establish due to the widespread poaching. Totals are about 3100 mt, although only 90 mt

were legally extracted in 1995 (Khrushchev 1997). This amount is expected to drop with time due to overfishing, poaching, and failure of the hatchery system. In contrast, in 1995 Shilat exported 146 mt from a total catch of 182 mt (Abbasian 1997). In 1997, Iran was able to export the legal production of Turkmenistan, which would increase its production in addition to its own resources. Iran has established a target of 250 mt of caviar for the year 2020 (Abbasian 1997).

Kilka

Although the sturgeon fishery is the highest-profile fishery, the kilka fishery is larger, employs more people, and has a higher potential for conflict. In 1995, Iran harvested 41,000 mt of kilka, with 2050 mt for domestic consumption and 85 mt for export; it has targeted over 110,000 mt for harvest, with 60,000 mt for local consumption in 2020 (Abbasian 1997). These figures are up from 1991 and 1992, when 14,000 mt and 21,000 mt were harvested, respectively. This represents in part the success of a planned change in per-capita fish consumption in Iran from 1 kg in 1985 to 4.7 kg in 1995. In 1991 and 1992, the kilka fishery provided employment for about 13,000 fishermen, which was more than 10% of the work force in

the entire Iranian fishing industry (Iran Public and International Relations Department 1995; FAO 1996). Further, Iran has developed export products based on fish protein concentrate (FPC) targeted at a far east market in Japan and China (Shojaei 1998).

At the same time, Iran's neighbor, Turkmenistan, lacks the capability to harvest its own kilka stocks and only took 7660 mt in 1995 and 8500 mt in 1996 of an allotted 45,000 mt (Hamlin 1998). The Turkmenistan fishing fleet was capable of meeting its harvest allotment in the 1960s and 1970s, when its fleet and processing plants were in good repair, but this is no longer the case (Hamlin 1998). Although the level of kilka catch in the other Caspian Sea nations is not reported separately, it represents a major source of income, food, and employment.

Caspian Seal

The Caspian seal has been both hunted and protected for decades. Estimated at 500,000-600,000 animals for the whole Caspian sea, it is native only to the Caspian, although it is related to the Ring Neck seal (*P. hispada*) of the subarctic and arctic regions (Vetter et al. 1995). Other estimates place the population between 360,000 and 400,000 (Yampolsky 1996).

An annual harvest of 40,000 seal pups is made in the Caspian Sea under what are alleged to be harvest quotas derived from the 1980s. Separate quotas for harvest allowances by Russia, Kazakhstan, and other Caspian states are not enforced. As in the case of sturgeon, accurate records are not presently kept in the north Caspian. The “white skin” pup fishery is said to be in support of German clients (Yampolsky 1996). Total net birth rate for the Caspian seal has been estimated at 50,000/year.

Recent anecdotal reports indicate some poaching on Maly Zhemchuzhny Island in the northern Caspian of *P. caspia* stocks by research institute workers tasked with studying the colonies on islands in the Russian sector off the Volga delta. Poached carcasses are alleged to be used for mink farm food in Astrakhan, but Kazakhstan is also implicated in the seal poaching (Yampolsky 1996). Overharvest and poaching seem to be major concerns. The study by Vetter et al. (1995) indicated that although organochlorine compounds were detected in the carcass of a natural mortality *P. caspia* found in Iran, DDT and its residues dominated the organochlorine compounds and were at lower levels than those seen a decade ago.

Introduced Species

Since the early 1920s, more than 30 species have been introduced to the Caspian Sea (Karpinsky 1992). As an example, *Corbulamya*, a small mollusk no more than 12 mm in length, was introduced by Russian scientists in the 1970s along with *Mytilus galloprovincialis*, the blue mussel, and *Dreissena polymorpha*, the zebra mussel, as food for sturgeon (Zevina and Maev 1972). Also, the Volga-Don canal connects the Caspian with the Sea of Azov by an open channel, allowing the introduction of species via the Volga River delta. The appearance of each new species has caused the rearrangement of bottom communities, and changes in their productivity and species composition. The probability of new species from the Azov Sea is high and may cause unpredictable results. Recently, concern has been expressed over the possible introduction of *Mnemiopsis leidy*, the comb jelly, which has caused severe ecological problems in the Black Sea and Sea of Azov (Newman 1998). However, Bronfman (1995) noted that at salinities below 13%, *M. leidy* will not thrive, as evidenced by its decline in the Sea of Azov during prolonged periods in the 1970s and 1980s of such salinity levels. Thus, it is doubtful that it will succeed in the Caspian Sea, because it

cannot tolerate the low salinity (Figure 7).

Aquaculture Production in the Caspian Sea

Historically, Russia maintained hatcheries in all of the modern northern Caspian Sea countries producing salmon, sturgeon, and trout for release to the Caspian Sea. Since 1991, production of sturgeon has been going down steadily due to financial strictures (Khodorevskaya et al. 1997). In Iran, Shilat has many species, including all three commercial species of *Acipenser*, in culture. Brood stock is presently a problem with sturgeon due to poaching in the northern and mid-Caspian Sea.

Iran has banned all netting in the open part of the South Caspian, which it controls (Abbasian 1997). Fisheries are concentrated on the near shore shelf, and large-scale hatchery releases of sturgeon, kutum, bream, pike-perch, and Caspian trout are made to ensure that the local fishery remains strong (Fish Farming International 1997; Abbasian 1997). Iran uses international cooperation from United Nations Food and Agriculture Organization (FAO), World Bank, and UNDP to develop technology and resources (Fish Farming International 1997; Abbasian 1997).

Oil Production and Fisheries Risk

Although several papers project potential ecological “disaster” in the Caspian Sea from drilling and its attendant chemicals and compounds (e.g., Kasymov and Velikhanov 1992), there is contrary evidence that points to lesser impact. Drilling in the Caspian, for example, will have to conform to ISO 9000 and ISO 14000 business and environmental standards, if the product is to be sold in the European Union (EU). This should mandate better environmental standards than those applied during the past 70 years under FSU control.

Use of the Environment as a Terrorist Target

The developing economic and political structures in the emerging independent littoral states of the Caspian region are especially sensitive to interruptions and threats. The use of western oil and gas infrastructure as a bargaining chip or terrorist objective can be heightened and brought to the international community’s attention through the environmental damage and potential sensational claims available to nationalistic and radical religious groups. There is a firm basis for this approach developing in Colombia: approximately one-third of the attacks were against U.S.

targets, and most of those consisted of low-level bombings of multinational oil pipelines in Colombia.

Oil and Gas Development

Background

A critical issue facing the region is the development of oil and gas reserves. The Caspian Sea and associated basins have been projected to contain the third largest reserve of oil and natural gas in the world, behind the Gulf region and Siberia. Drilling for oil in the region is not new. Oil derricks dotted the landscape during the latter decades of the nineteenth century. Oil was a major source of hard currency for the FSU, but drilling methods were technologically inferior compared with those of Western firms for large-scale oil exploration. This inhibited Soviet exploration in the Caspian region. In the mid-1980s, the Soviet Union's oil exploration sector was poised to reap benefits from the Western technology and investment; the breakup of the Soviet Union, however, put a hold on these plans, because several nations claimed sovereignty in the FSU lands around the Caspian Sea.

There are significant environmental concerns associated with drilling for oil in the Caspian region. Impacts are possible from five general

elements of the industry: exploration; drilling; production; gathering, transportation, and distribution; and refining and processing (Table 7).

The major issue regarding oil exploration in the region is a question of how best to deliver the oil to world markets. The Caspian Sea area is landlocked; thus, the only way to efficiently transport the oil to world markets is via pipeline. The exact route of such a pipeline is as of yet undecided, and may prove to be the single most important factor in determining the ultimate success of oil exploration in the region.

Pipeline Route Objections

The most frequently cited objections to routing pipelines across the Caspian are two related issues: active tectonic zones and mud volcanoes on the sea floor. In both cases these areas of concern are limited to the southern Caspian and pipeline routes can easily avoid the problem areas.

The region has two major belts of seismicity. One runs along the Zagros Mountains in southern Iran along the Persian Gulf. The other belt runs through northern Iran around the Caspian Sea. Earthquakes in this northern belt typically show strike-slip faulting. They are particularly hazardous

Responding to Environmental Challenges in Central Asia and the Caspian Basin

because many people live in this region. This northern seismicity belt connects the tectonic activity in Turkey, to the west, to the on-going mountain building and seismicity in the Himalayas to the east. A mud volcano is a small cone of mud and clay, usually only a meter or two high, built as mud is thrown

into the air by escaping volcanic gas from a bubbling mud pot. The mud and clay forms as volcanic gases dissolve in hot ground water, creating an acidic mixture that turns solid rock into clay-sized fragments.

Heavy tanker traffic thorough the Mediterranean, Red Sea, and Persian Gulf have already

Table 7. Vulnerability to Oil and Gas Exploration and Development Impacts

| INFRASTRUCTURE ELEMENT | PRINCIPLE ACTIVITY | ENVIRONMENTAL VULNERABILITY |
|--------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Exploration | Seismic acquisition Marine Onshore | <u>Onshore:</u> Effects of vehicle passage, energy sources and short hole drilling <u>Offshore:</u> Effects of energy sources on fisheries |
| Drilling | Exploration and Development Marine Onshore | <u>Onshore:</u> Leakage of drilling fluids, produced water and operational contaminants <u>Offshore:</u> Disposal of drilling cuttings, fluids and waste from operations, damage to sensitive marine ecosystems, seafloor damage <u>Both:</u> Danger of wellhead failure and blowouts with associated oil spills and contamination |
| Production | Gathering systems Production processing and location storage | Crude oil leaks during operations and transfer to gathering and pipeline systems. Modern (western) infrastructure minimizes these leaks significantly. |
| Gathering, transportation and distribution | Gathering systems Pipelines Barges Tankers Marine terminals | <u>Pipelines:</u> High likelihood of leaks, large volumes of crude oil <u>Storage systems:</u> Leak prone and highly vulnerable to operating conditions. <u>Tankers, Barges and Marine terminals:</u> spills, discharges, and leakage |
| Refining and processing | Crude refining Chemical intermediates Fuels | <u>Refineries:</u> Significant air pollution sources Significant ground water contamination Refined products with much higher toxicity and persistence in the environment |

alerted states to the pollution potential of such activities. Increased production in the Caspian region could increase the above effects, no matter which pipeline route is eventually chosen. Unique to the Caspian region however, are the ongoing sea-level changes. The sea could rise possibly 3 m in the next 25 years, with consequent environmental damage. In the last decade, it rose 1 m, already inundating some parts of Baku. Some of Iran's most productive fields lie on the southern shores of the sea and could be submerged if the sea were to continue to rise.

The petroleum issue needs to be quantified and mapped in accordance with modern pollutant transport modeling and with remote sensing. This task requires expansion, quantification, and integration of information obtained in environmental baseline evaluations with the projections and condition assessment of infrastructure challenges.

Environmental Vulnerability

The Volga contributes 78%-85% of the freshwater flow into the Caspian and therefore controls the fate of resources affected by freshwater availability. Because there is significant debate over whether the amount of Volga River flow or its seasonal to annual variability is anthropogenically controlled or a natural

fluctuation, it is not clear how to stabilize the Caspian Sea level. Without the ability or the knowledge of how to control the Caspian Sea level, resources that depend on the sea level stability are at risk.

Many investigators associate an anthropogenic control of the sea level with climate shifts triggered by human activity inside as well as outside of the Volga watershed, and therefore conclude that there is a shared, multinational responsibility for the Caspian Sea level fluctuation. Even if there were a single country that surrounded the Caspian Sea, there would still be problems and tradeoffs in solutions related to the sea level rise, pollution, and resource development; that is, the environment would still be vulnerable to damage, regardless of national politics. However, because there are multiple countries involved, shared legacy pollution and management issues, emergent highly profitable resources, divergent cultures, and debates over the scientific explanations for the sea level rise, there is no doubt that there will continue to be environmental vulnerability associated with the Caspian Sea level rise.

The most technologically developed areas of the Caspian Sea region, including Central Russia, the Urals, Azerbaijan, Kazakhstan, and

Turkmenistan, have had the greatest impact on the water quality of the sea. Increased urbanization, industrialization, and harvesting of natural resources have led to particularly heavy impacts in the northern region. In addition to pollution issues, the quantity and quality of fresh water is of cross-border concern; in other regions, water supply has been a flashpoint issue.

Fisheries in the Caspian Sea in general do not present a point for potential regional conflict. Most major commercial stocks are mobile and at stock levels beyond present harvest capability due to fisheries infrastructure failure in FSU countries. High-profile species such as sturgeon are at risk, but their decline would affect only local populations of harvesters and poachers on a seasonal basis. Poaching is a local and seasonal issue in the north and mid-Caspian, and will likely decline with the increase in catch per unit effort that accompanies over-harvest. The most likely primary point for fisheries-related conflict comes from the mixture of religion, economics, politics, and fisheries aquaculture that exists in the southern Caspian Sea. Iran and Turkmenistan share more than a common border in the south Caspian. Iran harvests and processes fisheries product for Turkmenistan, including caviar,

and probably shares some common religious heritage. Iran's ambitious aquaculture program is both an employment program for the local populace, a major dietary change program involving a shift to fish as a protein source, and an export product-generating program, with several foreign investment and support partners.

Combined with the major investment in aquaculture in Iran and the desire to maintain hegemony in the south Caspian in oil and fisheries, Iran could possibly initiate local- to regional-scale conflicts, if its aquaculture program were seen to be threatened. Potential ecological threats could include those due to spreading pollution from shoreline sources or to introduced species in tanker ballast water, or to ecoterrorism over oil rights/boundary issues and poaching.

There is public concern for potential radionuclide contamination in the Caspian, particularly because there are known contaminated sites that could be inundated with the rise in sea level. In the media coverage, there is a portrayal of anger directed at the FSU for poor handling of residual wastes and for PNEs and other sources of radioactive contamination in the former republics, now independent nations surrounding the Caspian.

There is potential for contamination from any of the sites associated with the FSU nuclear fuel cycle, including accidents at nuclear power or research facilities, and when it enters the sea, it becomes a cross-border issue. Although sites of nuclear activity are not as concentrated in the Caspian Sea region as in some other areas of the FSU, there are nonetheless a number of sites of potential concern. Near the sea, Armenia, Azerbaijan, Russia, and Turkmenistan all contain regional radioactive material dump or management sites, called *radons*. Former uranium mining and processing sites, sites of PNEs, nuclear waste injection sites, and others ring the Caspian and could pose risk for release of radioactive materials into the waterways that lead to the sea. Other sources of radioactive wastes are chemical factories that use activated charcoal in their industrial processes, such as those at Cheleken and at Nebit Dag in Turkmenistan.

Impacts are possible from five general elements of the oil and gas industry: exploration; drilling; production; gathering, transportation, and distribution; and refining and processing. Each of these elements has unique activities and vulnerabilities. By far the greatest vulnerability to large-scale environmental damage is the pipeline infrastructure.

Given the overall age and condition of existing pipelines and the proximity to the Caspian shoreline, which is changing, the likelihood of severe compromise of the system is high. Nonetheless, there are several concerns associated with each element.

The most frequently cited objections to routing pipelines across the Caspian Sea are two related issues: active tectonic zones and mud volcanoes on the sea floor. In both cases, the areas of concern are limited to the southern Caspian, and pipeline routes can easily avoid the problem areas

After a description of the environmental setting, the organization of the report features the following issues: regulatory baseline, sea level changes, water quality, nuclear baseline, fisheries, oil and gas development, and a summary of environmental vulnerability, security implications, and recommendations.

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THE WORLD BANK



By Mr. David Pearce

In the World Bank's view, the key environmental challenge in Central Asia is the allocation and management of water resources – partly a legacy of the Soviet Union and partly a function of the competing interests of the five riparian states.



Since the break up of the Soviet Union and emergence of five independent states in 1991, the economic policies and water needs in Central Asia have increasingly diverged, resulting in increased tensions over competing water use and allocations.

Water management infrastructure (dams and canals), trans-boundary water monitoring facilities (flow & quality), and massive physical infrastructure mainly for irrigation, but also for industrial and domestic use, is decaying. There are only limited resources available for rehabilitation,

repair and modernization and there is an increased risk of catastrophic failure of infrastructure (especially in Uzbekistan).

In addition, interests of upstream and downstream states in water use are now significantly different:

- Upstream states (Kyrgyzstan and Tajikistan) increasingly need water mainly for hydroelectric power generation during long winter months;
- Downstream states (Uzbekistan, Turkmenistan, and portions of Kazakhstan) need water mainly for irrigation during spring and summer.

During Soviet Union era, these interests were accommodated, if not reconciled unilaterally, by Moscow. Since the early 1990s, all five states have had to develop their own 'modus

operandi' and regional arrangements for cooperation. But, owing to their differing rates of economic reform, development and growth, as well as their competing interests for water, cooperation between upstream and downstream states is decreasing. Ultimately, there is a risk of conflict between them.

Existing national and regional institutional arrangements (e.g., ICWC¹, IFAS²) represent for the most part the interests of individual sectors – agriculture & irrigation, power, environment, etc. – and they are increasingly unable to deal with the broad range of inter-linked, multi-sector water-related problems, most notably the need to balance the demand for water for upstream hydropower generation and downstream irrigation. The result is that cooperation is hampered at present by inadequate institutional arrangements that take into account and integrate the interests of all sectors of both upstream and downstream states. In addition, the overall economic incentives for regional cooperation have declined, although recent external threats to security (Islamic fundamentalist incursions through Kyrgystan and Tajikistan to

Uzbekistan in 1999 and 2000) may be beginning to change these trends. Although there are differences of opinion between the five states, there is a long history of cooperation from Soviet times, and this continues in various, mainly single sector, forms. Included in this is short-term, pragmatic multilateral and bilateral water management undertaken by Deputy Ministers of Water Resources under the auspices of ICWC.

Ten years after the break up of the Soviet Union, existing single sector institutions such as ICWC are no longer adequate in a situation where the five newly independent states are each striving to develop their own identity at different stages of economic transition and with increasingly divergent economic interests. Water demand and use in Central Asia is multi-sector in nature, therefore institutional arrangements for water allocation and management also need to be multi-sector at the regional, national and local level. Ultimately, a new regional institution, or an existing one (e.g., CAEC³) is needed to represent, and reconcile the differing multi-sector interests of all five countries. First, data related to regional water use, allocation and management needs to be shared more widely with all the

¹ Interstate Commission on Water Coordination

² International Fund for Saving the Aral Sea

³ Central Asian Economic Community

parties and sectors concerned in all five countries (e.g. two WARMAP⁴-sponsored draft framework agreements, not yet signed). Second, at the national level, multi-sector coordinating points of contact, or bodies need to be established in each country (under Ministries of Economy, Finance, Environment, or Presidential Apparatus, for instance), with the political mandate and competence to synthesize the competing, even conflicting interests of various sector water users; and, to act as interlocutors representing these interests at the regional level and in negotiations with the international (donor and investment) community. Such focal points would facilitate:

- Negotiation and implementation of annual, multi-annual bilateral and multi-lateral agreements; and
- Provide guidance to ongoing and forthcoming initiatives designed to improve national and regional water management.

Finally, key to these recommendations is political will by all parties concerned, which, given the nature of Central Asian governments, will probably have to start with the five Heads of States themselves. It must be expressed officially and be translated into practical action.

- Coordination among national agencies and between national and regional agencies;

⁴ Water Resources Management and Agricultural Production

Responding to Environmental Challenges in Central Asia and the Caspian Basin

ORGANISATION FOR SECURITY AND COOPERATION IN EUROPE



By Ambassador Marin Buhoara

Thank you for giving me the floor. We welcome the initiative taken by the George C. Marshall Center to organize this action-oriented conference. It is an important step toward a structured dialogue in order to identify a coherent set of matters and actions for addressing a specific set of problems for each country while providing an overall picture at the regional level.



Cooperation among the states in the region is an essential factor for success. In this respect, we believe this conference paves the way for further cooperation.

As a security and cooperation organization, the OSCE (Organisation for Security and Cooperation in Europe) contribution in the economic environmental dimension consists mainly in identifying threats and risks to security and offering appropriate answers to these challenges as well as acting as a catalyst for cooperation between key

international organizations and institutions in these areas. The major challenges for our common security require a comprehensive response that encompasses all dimensions of the OSCE: human; economic; environmental; and military.

We do consider that these dimensions are interlinked. Environmental damage and negligence due partly to a difficult inherited situation and lack of resources and poor standards are very serious risks to security too. We share the view that in the environmental field, the OSCE should strengthen its capacity to follow developments in the area and provide early warning when environmental matters intersect with security and stability concerns.

Therefore one of the OSCE priorities in the environmental and economic dimension is to enhance the organization's

ability to identify threats in this field in order to improve its capability to prevent conflicts and assist in post conflict rehabilitation.

International cooperation among the participating states is essential in dealing with these risks. More coordination between them, particularly among the transition countries as well as among international organizations, is needed. The complex security situation in Central Asia and the Caspian Basin and the wide range of security risks faced by these countries require a proactive attitude from the OSCE. Our view is that we have to develop and implement comprehensive regional strategies taking into account the specific needs and conditions of each country and region. In this respect, local inputs are extremely useful. Also closer coordination with the field missions in this area will be important. The OSCE role in this area consists mainly in stimulating, facilitating and offering a framework for dialogue and cooperation, coordination and information exchange, including but not limited to, lessons learned elsewhere. The existence of OSCE field presence is a valuable asset to our organization.

Their activities in the economic and environmental dimension should be further upgraded and

their cooperation with other organizations present in the field should be encouraged. Within the economic and environmental dimension, the OSCE presence in Central Asia and the Caucasus focused and will continue to focus on terrain and weather management, soil and water contamination, management of information on environmental aspects of security, and focus the training on environmental issues on economic and environmental security building. Numerous seminars, workshops and training activities have been organized and more are to follow. In this framework, the OSCE presence, in cooperation with the Office of the Coordinator for Economic and Environmental Activities of our organization, developed a series of activities aiming to promote the Aarhus Convention on public participation in decision-making on environmental matters. For instance only during the last month:

- The OSCE Center in Ashgabad organized a roundtable on the implementation of the Aarhus Convention on access to information public participation in decision-making and access to justice in Turkmenistan.
- The OSCE mission to Tajikistan organized a roundtable on the Aarhus convention for Tajik ecological

nongovernmental organizations (NGOs) and governmental institutions.

- The OSCE center in Tashkent contributed to an international conference on health and mother and child in the environment dimension.
- The OSCE Center in Bishkek started preparations in cooperation with specialized Kyrgis NGOs for a regional workshop on ecological security in southern Kyrgystan.

In addition the organization of an international conference on the nuclear waste in Central Asia is envisaged with International Agencies and specialized UN Agencies. The Romanian OSCE chairmanship explores ways and means to enhance the follow-up process of proposals and recommendations stemming from seminars (including the one in Almaty on 2-3 November 2000) and the economic forums. We shall not confine ourselves only to the topics of the Prague Economic Forum. Environmental Security, management of nuclear waste, and water resources management should also be high on the agenda of the OSCE. Countries in the region should be more involved in joint activities of security related economic environmental matters of common interest.

The Economic Forum to be held in Prague on 15-18 May this year will also constitute and opportunity to dwell upon such issues. Within the general theme of transparency and good governance in economic matters, aspects related to environmental security could also be addressed.

At the same time, during the Chairman in Office visit to Central Asia, placing on the agendas of regional heads of missions and assessing them on a more regular basis in Vienna are other ways I envisage upgrading the environmental and economic activities of the OSCE.

May I take this opportunity to encourage a high level of participation from the Central Asia and the Caucasus in the economic forum as in its agenda there are matters of direct interest to the countries of these regions.

Before concluding may I express the hope that the George Marshall European Center for Security Studies will organize periodically such events both here in Garmisch and in their respective regions. An opportunity given to the civil societies of the respective countries represented here will further enrich the action-oriented dialogue and methods that are also of immediate concern of the citizens.

THE NATIONAL EXPERIENCES OF KAZAKHSTAN

Radioactive Pollution



By General Major Uraz K. Rakyshev

I would like to talk about the Aral and Caspian Seas; however, these subjects have been exhaustively treated in the previous sessions. Let me talk a little more about radioactive contamination in Central Asia. As you probably know, the most difficult issue is radioactivity because of the Semipalatinsk Nuclear Testing Ground that was shut down last year but existed for about fifty years.



General Delong; Ladies and gentlemen:

Radioactive and chemical pollution is a significant problem affecting the environment of the Central Asian region.

The rehabilitation of dumps of radioactive and chemical waste is one of the most pressing and

potentially dangerous problems facing the populations of Central Asian states. Their total number is 44, with a sum volume of waste exceeding 70 million m³ and dumps containing over 600 million m³ of rock and substandard ores on a territory of approximately 1200 hectares.

At the present moment, ten sites requiring the most urgent measures are located mainly in Kyrgyzstan and Tadjikistan: Mailuu-Suu, Ak-Tyuz, Sumsar, Shekaftar, Kadamjai, Khaisarkan, Degmaiskoye, Anzob, Adrasman, Taboshar.

Uranium is an important strategic raw material for military programs, therefore its acquisition and processing in

the Cold War period made it a primary factor in political and short term economic interests. In order to save time and money, waste storages and dumps were located close to the sources of raw materials, frequently in regional fluvial plains.

Presently, a significant number of waste storages, which are in a highly unsatisfactory condition, are affected by river flows which cause penetration of radioactive matter into underground waters, the atmosphere and the soil. An ecologically dangerous source of pollution are waste dumps which pose the threat of erosion of radioactive sand, which may affect not only the territory of a given state, but adjacent territories as well (waste dumps in the Navoisk region in Uzbekistan).

Currently, a great danger to the countries of Central Asia is inherent in natural phenomena: earthquakes, seasonal flooding, landslides and mud slides, and in possible terrorist acts by religious extremists which could cause the destruction of dams limiting waste dumps, the breaching of dikes and high altitude lakes on the territories of Uzbekistan, Kazakhstan, Kyrgyzstan and Tadjikistan.

If the water arteries of Kyrgyzstan and Kazakhstan become polluted by radioactive and toxic waste from the

uranium industry, such pollution could spread to the territories of Uzbekistan, Kazakhstan and Turkmenistan, affecting huge areas and masses of people in the region

This situation could lead to irreversible changes in both the local and regional environment, political tension, economic destabilization and loss, to rendering large agricultural areas unsuitable for cultivation as they would contain radionuclides and toxic additives for several decades.

Currently, the level of juridical, institutional, technical and financial options in the states of the region is inadequate to facilitate the planning, management and realization of the measures necessary in this field.

The former system of control and management of uranium industry objects has lapsed. No new system has been created yet due to the economic crisis.

In this instance, it is necessary to call upon Russia to carry out joint action concerning waste dumps, a remnant of the Soviet period, including consultative assistance and the release of archives containing full technical documentation on the objects of the military-industrial complex, including waste storages and radioactive burial sites.

Significant areas of Kazakhstan became subject to radioactive pollution due to the activity of the Semipalatinsk testing ground.

Over a period of 40 years, 470 nuclear tests were carried out at Semipalatinsk: 90 in the atmosphere, 26 on the surface, 354 under ground. Nuclear weapons tests in the atmosphere and on the surface were carried out up to 1963. Radioactive clouds from 5 atmospheric and surface tests fell outside the testing ground as well as the gas fraction of 69 subterranean explosions. It was these 124 explosions that caused radioactive pollution of the eastern part of Kazakhstan.

Apart from nuclear detonations, 175 explosions involving chemical explosive elements were carried out at Semipalatinsk. Of these, 44 had charges exceeding 10 tonnes.

According to archive data for the period 1949 to the 1990s, radioactive fallout in the Semipalatinsk, Pavlodar, Karaganda and East Kazakhstan regions spread over 304 thousand square kilometers with a population of around 1.7 million people. In 711 populated points the dose of radiation received by the population exceeded the annual norm (0.1 rem). Maximum doses received reached 448 rem

during the entire period of testing.

Lengthy heightened anthropogenic loads resulted in dire ecological consequences. The tests caused significant deterioration of the environment, the health of the population and the incidence of various pathological phenomena in both people and animals.

At this stage, it is very important to establish and analyze various specific effects which may have been caused by numerous nuclear explosions on the environment.

In order to assess the current radiative condition of the territory of the testing ground and the analysis and forecasting of the possible consequences of its peaceful use, the development of recommendations to stabilize the situation and lower the risk of radiation poisoning of the population, it is vital to gather, analyse and combine the results of numerous studies carried out on the testing site by various organizations at different times.

On the whole, there is currently a sufficiently serious approach to the given problem, and an adequately broad spectrum of measures is under way to ensure liquidation of the effects of the activities on the testing ground:

Responding to Environmental Challenges in Central Asia and the Caspian Basin

- Collection of retrospective cartographic and semantic information concerning the activities on the testing ground and the formation of a unified, integrated data bank;
- Integration and collection of monitoring results (surface observations and long-range soundings) of the environment in the region of the testing ground;
- Study of the means and mechanisms of the passing of nuclides to the population and assessment of their effect on human health;
- Study of the results of lengthy radiative pollution on different types of ecosystems.

However, it must be noted that it would be hard for Kazakhstan alone to liquidate all the consequences of the testing ground activities. The technical and financial possibilities of the republic are inadequate to cope with the scope of the ecological disaster. The problems of the Semipalatinsk testing ground, despite their specific nature, are of significance to the whole region because the level of environmental pollution at the site poses a potential threat to neighboring countries. Therefore, it is vital to focus the attention of the leading countries of the world, international organizations and the entire international community on this issue.

THE NATIONAL EXPERIENCES OF KYRGYSTAN



By A. Sarnogoev

Thank you for giving me the floor to speak about the regional challenges in central Asia. Let me focus on some common issues. In the Former Soviet Union, natural and other disaster response was part of civil defense. As Central Asian States gained independence, they used the same system to establish Ministries for Emergency Situations that used some of the military assets of the Civil Defense System. Rescue work and emergency response activities very much depend on historical conditions. There are some similarities in that our Ministries for Emergencies are in charge of these matters in all of our countries. The involvement of the military is also a feature that is common – as in flood response efforts. Armed forces were involved and they saved about 3,000 people.



We are a mountainous country. Things happen very quickly and we have to respond in a very quick manner. Therefore there is some cooperation among Central Asian Emergency Ministries. There are agreements on information exchanges and warning.

Together with the Uzbek Emergency Ministry, we conducted a joint exercise to train operations to eliminate nuclear waste. The exercise ensured we had a common understanding of the issue – we are thinking along the same lines and have very good institutional cooperation.

The Council of Independent States (former Soviet republics) is also a community of countries with agreements on mutual assistance in emergency relief. There are some provisions that relate to financial assistance as well. My colleague has just spoken about

his concern over nuclear waste. This is very understandable because most of these sites are in Kyrgystan and if there is some damage done to these sites, they could pose trans-border threats. Things like that happened in Soviet times (e.g., dam breaks in the Aktuz area). Kazakhstan is also very vulnerable. If the Mailuu-Suu storage site is broken then damage will also be trans-border. So the work that began back in 1992 and 1993, is now becoming increasingly important. My Kazakh colleague made this point very well. It reflects our common concern. So let me join the previous speaker and appeal to the international community, to the World Bank, and in particular OSCE, to urge them to focus more attention on these problems, although they are absolutely aware that the problems of nuclear waste and other types of toxic waste is severe.

Let me note that there is increasing damage in the areas where this waste is stored. We are very much concerned and therefore have begun a series of studies on the geological conditions of these landfills to determine whether or not earthquakes, mudslides, or other natural disasters will compromise the integrity of these sites.

In this case, because of their mobility, the armed forces could play a role. As a nation, we lack major disaster response companies like those shown in the previous presentations, so this work must be financed out of the state budget. Using the armed forces, therefore, is an option upon which we often rely. They frequently participate in rescue and relief operations.

THE NATIONAL EXPERIENCES OF TAJIKISTAN



By Colonel Bakhrom Mamadaliev

General Delong, ladies and gentlemen, and esteemed colleagues: let me extend the greetings of the President of our young sovereign state. On behalf of President Rahmonov and the Tajik government, and on behalf of the representatives of our government here today, I would like to wish everyone success and good health.



Because of its geographic situation and as a result of the disintegration of the Soviet Union, and the turmoil in Afghanistan, Tajikistan is in a locked area:

- We have no access to seas.
- We have no roads that can operate throughout the entire year.
- We have no trade routes.

For this reason, we do not have good prospects for long-term economic development and very much depend on our neighbors.

We depend on their good will, and their understanding the need for stable development both nationally and regionally. Our hosts, the George Marshall Center, understand well that history has shown our ancestors set up primitive community social systems in their effort to survive. Today the time is right to pool forces in the face of environmental dangers. We are perfectly aware that some of the environmental processes are irreversible now – I am referring to the ozone layer depletion problem, the global warming problem, and the lack of potable water. President Rahmonov of Tajikistan, addressing the United Nations General Assembly has proposed to declare the year 2003 as the year of clean water to underscore the scope of this common problem. The General

Assembly subsequently declared this year as the year of potable water. A number of measures are being developed to promote our contributions to making progress in resolving these problems.

The need for regional cooperation derives from the challenges facing us in real life and all Central Asian countries are well aware of this need. In the previous panel discussion, I said that we already have an interstate council and a fund that deals with the Aral Sea problem. When I made my comment, I assumed that not enough information was available on the activities of these entities. The presentations we have had so far, however, indicate that our speakers are very familiar with the efforts of the World Bank in Central Asia in the area of environmental protection and with projects dealing with water management, disaster response and climatic changes. In 1998, 1999 and the year 2000, the World Bank allocated \$6 million to Uzbekistan alone to deal with these challenges.

Tajikistan has been the initiator and a strong advocate of a wide range of regional programs. As you probably know, the Executive Council of the Aral Sea Fund is going to move from Ashgabad, where it is currently located, to the Territory of Tajikistan where it is going to

perform in the next 2 years. During this time Tajikistan's President will act as Chair of this fund. At the same time, the International Year of Potable Water will be held and I hope, together with our partners in Central Asia and with your assistance, we will be able to make a contribution to the International Year of Potable Water.

Let me talk a little bit about what my country did from 1997 to 1999.

During this period of time, we had 599 emergencies – and I am referring only to natural disasters. These things happened because Tajikistan is so vulnerable – its economy is vulnerable and its infrastructure is vulnerable. What this means is that we do not necessarily have to face large-scale environmental disasters. We have problems when we merely have more rain than usual or when temperatures are colder than usual. In the Parhar District, an earthquake that measured five points on the Richter Scale took place and, as a result, 270 houses became uninhabitable. The reason for all that is the high degree of vulnerability of the Tajik economy and the corresponding low standard of living of the Tajik people. This is an issue for all of us to address – it is on the agenda of this conference and a focus of our

attention. I do not have to tell you that poverty breeds political instability, economic instability, drug addiction and other negative phenomenon in my country.

I have information on damage caused to the population and economy of my country as a result of natural disasters from 1997 to 1999. I am not going to read out these numbers. I will submit the text of my presentation to the organizers of this conference so that it will be available to you.

It is extremely difficult to cover all problems relating to disaster response in a short presentation. The issue of radioactive waste was addressed by a previous speaker – and is a serious problem in my country as well.

In 2000, an International Atomic Energy Agency (IAEA) commission visited my country. It made a tour of all radioactive waste storage sites and assessed the safety. The conclusion was that urgent measures are required to modernize these sites. On the 16th of March another IAEA commission is going to visit Tajikistan. Tajikistan has applied to join IAEA. The application was considered and approved, so we hope in the future that IAEA will be able to help us remove this danger. We also hope that the international

community will be able to share with us technologies that make radioactive waste storage sites safe.

I would also like to talk a little bit about the Sarez Lake. Unfortunately it is not shown on this map. The Sarez Lake lies at an altitude of some 4,000 meters above sea level. Sarez Lake was formed in 1911 as the result of a very strong earthquake. Today it holds some 17 billion cubic meters of water. The Sarez Dam, which has so far been performing very well, no longer meets safety requirements. Some experts believe that earthquakes like the one in 1911 happen in our region once every 100 years. The risk increases for another environmental disaster. We should reckon with and prepare for this possibility.

You certainly know about the civil war in Tajikistan, which broke out as a result of war in Afghanistan. Tajikistan was the only country from the former Soviet Union that went through a civil war after the former Soviet Union collapsed. Tajikistan is still dealing with the consequences of this war. I think the efforts being made today by the Central Asian countries, and the efforts of the international community (which responded to the appeal of the Tajik President to help mitigate the dangers that I described earlier) indicate that this is a

matter of international concern. There is a program of the World Bank, now being implemented. The Swiss government is helping us to develop a concept and prepare recommendations for mitigating the risk posed by Sarez Lake:

- An early warning system is going to be put into place.
- People will be trained on how to respond if the dam fails.
- Reserves of food and supplies will be established to sustain people until help arrives.

If the water from the lake flows down into the valley – and it is estimated that it will take the water some 36 hours to reach the valley – it will form a wave some 70 meters high and will move at an incredible speed. This is a very serious danger, a grave concern – a matter that is now being investigated. The early warning system is already in operation in the Bahtar valley, which was earlier considered to be at no risk at all. The system that existed in the Former Soviet union envisaged evacuation of the people who lived 500km away from the lake or longer distances away from the lake because the Soviet authorities didn't think it necessary to evacuate people closer to the lake – that area was considered to be hopeless.

The system established today envisions evacuation of people who live as close as 4 km away from the lake. There is, therefore, an enormous difference between the earlier system and the system we are now implementing. Another thing this program envisions is developing a long-term strategy to make Sarez Lake safe. The level of the lake will be brought down to a safe level or new technologies will be applied to put the water resources of the lake to some economic use. Technologically, it is possible. Economically, it has to be examined. This is a scantily populated area. It is uncertain whether using the resources of Sarez Lake to produce electrical energy is economically feasible. In any case, we have a lake that contains 70 billion cubic meters of pure water. It is a very valuable resource that I am sure will be put to good use.

Environmentally induced migration poses another serious problem. For Tajikistan, this problem derived from an outflow of people. In the 1940s, many people were re-settled from mountainous areas. They had to move to the valleys where there was arable land to develop. After the Soviet Union collapsed, the strategy of agricultural development was reconsidered.

Today some 8,500 households have to again be resettled

because they live in unsafe areas. They are at risk to earthquakes and landslides.

If you look at a map of Tajikistan, you will see that we really do not have much space to re-settle these people again. This is another matter to address. Let me also say, as was pointed out earlier by other speakers, we have intergovernmental commissions that deal with these issues. It is true that we have very serious issues – we cannot deny that. There are problems that affect all countries of Central Asia and there are issues where the interests of Central Asian countries do not coincide. All Central Asian countries were affected by the economic crisis that gripped the former Soviet Union in the 1990s. All want to raise the living standards of their people. This is understandable, but I would like to take advantage of this opportunity to urge my Central Asian colleagues to take into account not only the interest of their own countries, but the interests of the other countries of the region, because we all depend on each other.

Tajikistan is a big country where $\frac{3}{4}$ of the waters that flow to the Aral Sea have their origin. Many glaciers in the Tajik mountains become smaller. The Shevchenko Glacier, which provides water to the River Pyandj, lost some 30%

of its water in the last 25 years. Some smaller glaciers have disappeared entirely. What this means to all of us is that we will have less and less water in our rivers in the immediate future – water resources badly needed for irrigating our fields.

We have so many serious problems. But there are no insoluble problems. Where there is a will, there is a way. If people conduct a dialogue in order to find common solutions – if they join efforts to deal with problems together – I think it is very good and something to work for.

I would like to thank the organizers of this conference for making it possible for us to attend. I would like to thank them for their interest in the environmental challenges facing Central Asia.

Let me also suggest that we should continue this dialogue. I think it might be a good idea to conduct another conference on environmental issues in Tajikistan. We would be happy to host you. You will see with your own eyes that Tajiks are a very hospitable people. They are a peaceful nation.

THE NATIONAL EXPERIENCES OF TURKMENISTAN



By Colonel Rafik Turayev

General Delong; ladies and gentlemen: On behalf of the Delegation of Turkmenistan, I would also like to thank the George C. Marshall Center and the other organizers of this conference for its excellent organization. We have both very good working conditions and excellent accommodations.



As previous speakers said in their presentations, one important issue, not only for the five Central Asian countries but also other countries of the Former Soviet Union (the trans Caucasian countries for instance), is emerging democracies. It was only 10 years ago that they became independent. A country cannot, in such a short period of time, achieve the high level of cooperation enjoyed by west European countries. International organizations,

particularly the World Bank and individual countries of Central Asia, however, have been making very vigorous efforts to deal with environmental challenges – we are on the right path. There is still much to do, but I am sure we will achieve cooperation on all of the important environmental matters.

The Aral Sea problem has been in existence for many years. It existed when my country was a part of the Soviet Union. But the Soviet authorities thought that there was nothing to be done about the Aral Sea. On the contrary, it exploited the situation. A large bacteriological and chemical weapon-testing site was established there and we are still dealing with the consequences of that decision. It still has an impact on the supply of drinking water

in my country. But after the Central Asian countries became independent, they established a committee that has done much to mitigate the Aral Sea problem and to slow down the degradation of the Aral Sea. Other speakers pointed this out earlier. True, we still have a long way to go. My country has a committee on the Aral Sea problem and we badly need coordination of regional efforts in order to resolve this problem.

Turkmenistan also has a program of environmental action that includes water management, irrigation, and other environmental issues. Climatic conditions in Central Asia require irrigation. This is a fact we must live with. My government has been taking vigorous steps to reorganize and restructure agriculture in my country. In the past, agriculture resulted in the salinization of the soil and the depletion of water resources. What we are exploring today is establishing a drainage system that will evacuate water from the fields after it has been used. This water will be stored and reserves of water will be established. The water will contain some salt, but we are confident that we will be able to put it to good economic use.

Joint operation of oil fields in the Caspian Sea is another issue that I am sure we can address together. Much is

being done at this point in time. A regional conference of heads of state is going to be held very soon and we hope that these negotiations and consultations will yield results.

Another matter that we did not deal with when we were part of the Soviet Union was deforestation. We have a large-scale program to plant new trees and hope that this measure will also help to improve the environmental situation. There are many examples of this kind.

With regard to the military aspects of disaster response, I would like to say that today Turkmenistan is free from all nuclear, chemical and biological weapons. All materials were taken back to Russia shortly after my country became independent. In 1995, Turkmenistan adopted a declaration of neutrality. This declaration was supported by nearly all of members of the United Nations. This status provides the basis for our military activities. Our military strategy does not envision any large-scale defense programs. We build our activities on the principle of defense sufficiency and neutrality.

As we listen to presentations at this conference, we can see that environmental matters are issues of great interest not only to Central Asian countries, which have to live with these

environmental problems, it is also a matter of interest to trans-Caucasian countries. We all share the same planet, therefore we cannot limit our vision to our direct environment. What we need is a common approach – a common vision – for all people in the world. This makes us hopeful and confident that the countries of the Central Asian region will take all measures required, though we will need help from outside the region. We cannot address these problems single-handedly. What is needed is the effort of the entire international community.

THE NATIONAL EXPERIENCES OF UZBEKISTAN



By Colonel Rinat Zalyaletdinov

Mr. Chairman; ladies and gentlemen: On behalf of the Uzbek delegation, I would like to thank the Marshall Center for the invitation to attend this conference that will examine very urgent problems of the entire region. Indeed the inviolability of human rights – of the rights not only to life, but also to a normal environment – is essential for human development. This is a key principle of our policy. Today, as we listened to presentations by our neighbors in the region, it was not coincidental that they were very harmonious. We have a common destiny and we have common problems, which we try to tackle together in the area. We have a proverb in the East, “in order to see something well, you need to look at it from a distance.” It came as a pleasant surprise that experts from the Marshall Center understand very well the problems facing our region. Whenever there is clarity on a problem, there is a better chance to find solutions.



The most urgent regional problem is water. Water is the source of life in the east. It is not by chance that water caused wars in the past. As it is a source of life today, it is as valuable as any other commodity. So we need to

tackle these issues at the inter-governmental and regional level. And this is what we are doing. Eighty percent of the water resources available in Uzbekistan originate outside of its borders. We are thus very much dependent on the environmental condition of the water flowing through our country. Eighty percent of our population is engaged in agriculture. In many respects, therefore, the availability of water resources determines the economic condition of our country.

Let me highlight some of the issues relating to water management and allocation of water resources in my country. As pointed out by our Tajik colleague, there are two aspects to the water problem: It is bad when there is too much water and it is bad when there is not enough.

Regarding the excess problem – specifically the Sarez Lake issue – the lake contains 17 km³ of water. If there is a break in the dam, five states will be exposed including Uzbekistan. The Surkhandarya Region will be flooded, the entire Khorezm area, the poor districts in the Bukhara area, and the Karakalpak Republic will be flooded. It was also noted earlier that six or seven days after a dam break a ten-meter high wave would reach the area of the Aral Sea. If the dam is broken, you can only imagine the scope of damage to the environment and the population. It will be global in scope.

The next point I would like to make concerns the landfills or mine tailings mentioned by my Tajik and Kazakh colleagues. Those landfills also pose a danger to Uzbekistan in the event of a natural disaster. The Modditysur Storage Site can be damaged as the result of an earthquake or landslide. This would contaminate 200,000 km² in the Ferghana valley. I

think these figures speak volumes to the scope of a potential disaster.

Now regarding the military aspect – the participation of the armed forces. I represent the Ministry for Emergency Situations. On March 4th, we celebrated our 5th Anniversary at the Ministry. The Emergency Ministry of Uzbekistan is a special agency with responsibility for management and control as part of the overall state system of prevention and response. It is responsible for coordinating the various agencies that would be involved in a response effort. Because of this, we have established a number of laws governing the participation and responsibilities of the various agencies and ministries. In particular, there is a Cabinet Minister's ordinance that provides for the classification of disasters. It includes also environmental emergencies. Additionally, last August we adopted a law on protecting the population and the territory against emergency situations. One of the priorities of that law is to focus on preventive measures to protect the health of the population and to prevent natural and man-made disasters.

Concerning measures to improve the environmental situation, every year starting in March, we implement measures to improve the drainage

systems in our canals. We strengthen the dams and dikes where there is danger of avalanches and landslides. In addition to engineering works to strengthen the dams, we provide additional incentives to the local authorities, as in Tajikistan. These incentives serve two purposes: first, to improve the environment; and second, to improve prevention.

In this short presentation I did not go into much detail. But let me say that since we stem from the same system, we have a lot of similarities. We have

common approaches. Whatever concerns prevention of both natural and man-made disasters, these prevention measures and problems are very similar. I think it's very good that we have identified problems, but we need to move beyond that: we need to develop solutions – solutions to the global challenges facing the region. Such solutions require joint responses. Some of those, like the Aral Sea problem, require not only regional but global responses: responses by the entire international community.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

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A SYSTEMATIC APPROACH TO THE PROBLEM OF HARMONIZING THE ACTIVITIES OF THE MILITARY IN ENSURING ECOLOGICAL SAFETY

By Colonel Pernehan Yermekbaev
and
Mr. A. Kuandykov

Ladies and gentlemen: If I had been told fifteen years ago that I would be discussing environmental issues on the other side of the divide, I would have thought I was going crazy. Thank you very much for this opportunity. The military used to destroy in the past. These days, headed by you, sir, and other military leaders, we are very much concerned about the environment. The earth is very small – we are all children of the earth.



History has shown that the activities of the military have always been connected with a desire to change an existing state order and destroy all that was created by the state system, which was an opposing force. However, military battles were limited to mechanical influence and had a parade effect.

In the contemporary setting, the activities of the military have a broad character and exercise a complex influence on the environment, such as:

mechanical, chemical, thermal, bacteriological, radioactive, etc. The scope of military activities has widened and includes: outer space, the surface of the earth and water, the subterranean and underwater space. This was demonstrated by military conflicts in the Persian Gulf, Kosovo, et al.

The matter of human existence on earth must stand above the creation of new methods of armed conflict.

In view of the importance and the varied nature of questions concerning the protection of humans and the environment, the problem we are concerned with here, calls for broader consideration. We should talk about harmonizing the activities of the military with the environment. The aim of achieving harmony is to ensure that the

armed forces are the protectors rather than the destroyers of the well-being and security of the population – that they not only protect the people from external enemies, but also their environment.

Moreover, the problem of harmonizing the activities of the military with environmental issues should receive complex consideration, taking into account the entire spectrum of issues concerning the interaction of man and the environment.

However, the achievement of this objective faces certain difficulties. First, market mechanisms do not operate in the military sector. Second, ecological issues are not market problems in themselves. Thus, the solution to these problems does not lie in the area of market economics, but in the strategic policies of the state and military administrations.

With regard to the problem under discussion we suggest the following:

- That the military doctrine of a given state, apart from defense of the country, should embrace the mission of protecting the environment.
- That there is a need to create a corporate system of ecological thinking among the military.

- That we must introduce the principles and ideas of virtualizing the activities of power structures. Moreover, they should be based on the interfaces of standards of open systems.

- That we must adopt a unified system of state standards at all levels.

We believe that universal acceptance of the proposed system would lead to a decrease in military spending and thus facilitate the solution of problems connected with the protection of the environment.

Aspects of solving these problems call for the implementation of COTS technologies (Commercial Off-The-Shelf - "ready for use").

The normative base of COTS technologies should be developed and maintained within international (IEC, ISO) and national (ANSI, DIN, IEEE, GOST) standards organizations and take into account the work of large professional international consortiums (ARINC, PCISIG, VITA, PICMG, Group IPC, etc.).

THE CONTEMPORARY GEOTECTONIC STATE OF THE ARAL SEA BASIN AND ASSOCIATED NATURAL PROCESSES

By Mr. Anvar Nurhodjaev

The Physical security of the economically important Aral Sea basin is greatly affected by tectonic activity. The present situation of the earth's crust and its future changes are mainly characterized by the manifestation of present tectonic movements, namely by their orientation, trends, and rate as well as by its activity of fracture faults.

These factors affect intensities of erosive dissection of relief, and hence the intensity of development of exogeneous processes (landfall, mud flow, landslides, creeps, and gorge erosion) as well as the depth stress state of earth (tectonic anomalies and earthquakes) and the state of both sub-surface and surface water (salinization, ascent of ground water level, and wash-out).

In this context the rate of tectonic movements and trends of their change by time are of decisive importance. Likewise extremely important is information on morphological, kinematic and dynamic characteristics of active fractures and micro-cracks of the earth's crust surface layers. These parameters tell us about tectonic anomalies (stress) of one or another region which directly affect the state of natural ecosystems.

Let us consider more closely relevant problems of specific regions of the Aral Sea basin. Latest and present tectonic movements were determinant in formation of present Aral Sea relief. It intensified its impact in this region by the end of Miocene - at the beginning of Pliocene and continued through - the Post Tertiary Era.

An analysis of orientation and speed of the latest and present tectonic movements of the Aral Sea basin indicate two major geo-tectonic areas:

- The orogenic cycle from the beginning of Neogene, during which intensive differentiated tectonic movements took place; and
- The tectonic plate cycle during the whole period of Neogene, when relatively moderate tectonic movements took place.

Studies of structural elements of these two geo-tectonic areas have revealed their morpho-kinematic characteristics, the bulk of which started to emerge at Mesozoic Era and developed up to latest times as inherited, having undergone some axial displacement of structures. Latest structures also turned out to have a character of reverse development, namely Post-Tertiary structures up to present times, which periodically changed direction of movement.

Positive structures of the tectonic plate region of the Aral Sea basin are classified in the following eight groups: *Mangyshlak-Ust'jurt, Tuarkyr, Centralnye Karakumy, Centralnye Kyzylkumy, Sultanuizdag-Tokhtakair, Dzhusalin, Karatauk and Juzhno-Priaralsk*. And they all consist of minor sub-structures.

Negative structures of the tectonic plate of this region are classified in the following seven groups: *Severo-Ust'jurt, Vostochno-Aralsk, Juzhno-Mangyshlak-Ust'jurt, Amudar'insk, Syrdar'insk, Chu-Sary-Suijsk and Murgab*. Negative structures of the tectonic plate part of this region also consist of relatively minor sub-structures.

Similar positive structures can be also identified in six major

groups, each of which having a lot of minor sub-structures. The following ones belong to the positive groups: *Juzhno-Tienshan, Chatkalo-Kuramin and Severo-Tienshan*.

And the following ones belong to the negative groups: *Fergana, Afgano-Tadzhik and Narin*.

Plicated structures in the orogenic region mainly have linear shapes irrespective of their order and are clearly distinctive in the relief, whereas plicated structures in the tectonic plate region are of isometric character and are little distinctive in the relief.

Complication of the latest plicated structures of the region by fracture faults is closely connected with their neotectonic activity.

Amplitudes of rise and fall of latest structures of the tectonic plate region are not big and inferior to those of structures of the orogenic region.

Accordingly, the size of latest sediments, which fill cuts and depressions of the plate region, ranges from some hundred metres to one or two kilometres, whereas the size of those in depressed areas of the orogenic region ranges from several hundred metres to several kilometres. Intensities of neotectonic movements gradually grow in time (e.g., if the rate of

tectonic movements was 0.1 mm/p.a. in the neogene and 0.5 mm/p.a. in Post-Tertiary era, it is now 3-4 mm/p.a. and more).

By contrast to orogenic deposits latest sediments at tectonic plate depressions mainly consist of fine fragmental rocks.

Dynamic developments of latest structures today can be seen from instrument readings of present tectonic movements by means of measurements by geodetic control stations as well as from seismic instrument readings and satellite survey.

As can be seen from data of repeated levelling by geodetic control stations located at the Aral Sea basin, depressed areas sink as follows:

- *Fergana* 4 mm/p.a.,
- *Syrdar'ja* 1-2 mm/p.a.,
Amudarja 2-3 mm/p.a.,
- *Murgab* 3-4 mm/p.a.,
- *Chu-Sarysu* 3 mm/p.a.,
- *Narin* 0.3mm/p.a.,
- *Gazlij* 2 mm/p.a.,
- *Pitnjak* 0.2 mm/p.a.,
- *Dengiz-Kul'sk* 1.2 mm/p.a.

Apart from heavily sinking earth's crust structures there are structures in the Aral Sea region, which are rising as follows:

- *Vostochnoje and Juzhnoe Priaral'e* 4 mm/p.a.,
- *Grjada Tuarkyr* up to 13.3 mm/p.a.,

- *Centralnye Karakumy* 5-6 mm/p.a.,
- *Predkopeddag* up to 3 mm/p.a.,
- *Centralnye Karakumy* 10 mm,
- *Zaravshan* up to 3 mm/p.a.,
- *Western downthrown block of Zaravshano-Gissar underground plant* 7-8 mm/p.a.,
- *Beshkent-Kashkadar'insk* 3-4 mm/p.a.,
- *Tashkentsko-Golodnostepenskij and the elevation of Pritashkentskikh chuleij* 2-3 mm/p.a.

Thus the Aral Sea basin at present and at latest times undergoes differentiated tectonic movements, which brought about positive and negative structures, one of which develops inherited, whilst other develop reversely and third ones are axially displaced.

Such a development of latest and present structures will undoubtedly affect the present situation of river beds, their flow-off conditions, sedimentation, discharge of solid matter at length of the river bed as well as subsurface flow-off at the active water exchange zone. Eventually all this will have its effect on a change of natural ecological conditions of Aral Sea basin environment. Relevant examples may be cited from history of Aral Sea development,

whose configuration and size changed nine times in the last 10,000 of years as a result of complex tectonic movements of the earth's crust and then exhausted completely.

Moreover tectonic movements also brought about migration of middle and low flows of the basin's main hydrographic networks as well as burial of cities and oases in the sands of Kyzylkum and Karakum deserts.

Apart from technogenic factors we believe that present exhaustion of the Aral Sea is also closely connected with latest intensified tectonic movements.

According to geodetical surveys, the whole Priaral'e territory rises, and even those parts, which had sunk before, in particular its eastern and southeastern parts, which rise quicker than all the others. These rises may well be connected with different volumes of water cuts in the Aral Sea water area.

Re-distribution of subsurface water flow-off lead to its intensive accumulation in depressed areas of foothills. At present they started to have strong negative effects on the environment. Any accumulation

of subsurface water adversely affects soil-bearing capacity and causes salinization, ascent of ground water level etc.

In addition to the basin's water resources, seismo-tectonic conditions of the region are also closely connected with the development of latest and present tectonic movements.

Statistical analyses of hypocenters revealed, that heavy earthquakes focuses are mostly located at the boundary of latest structures, which have undergone intensive developments. The following earthquakes belong to this group: *Ashkhabad (1946), Tashkent (1966), Nazarbek (1980), Gazly (1976, 1984) etc.*

That is why in projecting activities of protection and forecasting of natural processes, in drawing up subject matter sheets, land and ecological registers as well as in decision-making on complex and many-sided tasks related to major national economic projects, present geodynamic conditions of the region must also be considered, since any sustained functioning of objects in addition to technical merits is also determined by the level of well-documented surveys of natural processes.

CHAPTER 4 – *National Focus: Military Role in Environmental Security*

Panel Moderated by Mr. Curtis Bowling

*Military Roles in Environmental Security:
Military Stewardship*
Mr. Curtis Bowling

*Reasonable Military Actions for Mitigating
Environmental Damage*
Major General Dennis Jackson

Turkey Earthquake
Brigadier General Ali Fuat Sarac

*Military Environmental Stewardship in the
Philippines*
Colonel Victor Corpus



Responding to Environmental Challenges in Central Asia and the Caspian Basin

MILITARY ROLES IN ENVIRONMENTAL SECURITY

Military Stewardship



By Curtis Bowling

Today, we shift from a global to a national focus, and begin to concentrate on the military's role in environmental security. I was very taken by Colonel Yermekbaev's comments yesterday afternoon. In particular his comment that the militaries "peace mission" should include as a priority the protection of its people from environmental threats.

My panel will examine three different aspects of how militaries can protect their people from environmental threats.

First, I will provide an overview of why I think it is important for the military to protect the environment as they train and conduct their day-to-day activities. Major General Jackson will then provide some examples of how the US military has incorporated the environmental ethic in the way we do business.

Secondly, Brigadier General Sarac will tell us about the lessons learned from the Turkish military's response to their recent earthquakes. While disaster response is a traditional military task in most countries, I believe the Turkish military role in this case was the type of military leadership that Colonel

Yerkekbaev spoke of yesterday – and is a good case study for this group. Perhaps the lessons learned from the Turkish earthquake, the Valdez oil spill, and this afternoon's session on "Military Response & Support to Civilian Authorities" might provide a good starting point for a regional disaster response initiative.

The last aspect of the military's role in protecting the environment is truly an example of how the military can use the environment as a tool to reduce tensions and conditions that lead to conflict.

Other militaries around the world have taken on non-traditional duties – for example:

- The Mongolian military oversees forestry and fights forest fires,

- Some Gulf State Navies protect fisheries and watch for illegal dumping of hazardous waste,
- Thailand's military patrols forests to prevent illegal logging.

In my panel today, Colonel Corpus from the Philippines will tell us about a unique military/interagency partnership which focuses on community-based reforestation. The reforestation effort will eradicate the root causes of insurgency (poverty and economic inequality). Yesterday Professor Butts showed us a triangle representing the hierarchy of human needs [page 2-4]. Professor Butts said that traditionally environment has gone at the top of the triangle, but he suggested that it should go at the bottom of the triangle. Protecting and enhancing the environment is essential in some cases to obtaining the basics – food & shelter, health & physical security, economic growth etc. Colonel Corpus's case study is a great example of "environment" being at the bottom of the triangle. I would ask that the group consider further examining these non-traditional military roles in their discussions.

Now I would like to turn briefly to an overview of why environmental performance is important to the day-to-day operations of the military.

Environmental protection is critical to military readiness

- It ensures continued access to land, airspace, and sea to support realistic training operations. In the U.S. we have a lot of competition for training areas and in an open society, a lot of scrutiny from the public and environmental regulators (it has been my experience that other militaries around the world are also experiencing similar problems).
- Also, environmental protection ensures realistic training can be sustained (for example, barren landscapes have little value for training).

Environmental protection protects troops and communities. It:

- Reduces health threats
- Minimizes exposure to hazardous materials/waste
- Improves quality of life by preventing polluted air/water

Environmental protection is good business

- It improves efficiency: pollution prevention solutions are cheaper and faster than traditional methods
- It can reduce current operating costs
- It minimizes future costs for Cleanup of contaminated sites and restoring lands damaged by soil erosion.

REASONABLE MILITARY ACTIONS FOR MITIGATING ENVIRONMENTAL DAMAGE



By Major General Dennis K. Jackson

Not many years ago, environmental issues were of little concern to us. We have since discovered our lack of knowledge and sensitivity to environmental concerns resulted in significant environmental damage and degradation of our land, water, and air. This discovery has led to a complete change of attitude and actions, and has increased our awareness of environmental issues. The U.S. Central Command environmental program is built around our critical concern for these issues. Now environmental concerns are an integral part of nearly everything we do.

This paper provides a brief review of our environmental history, how our attitudes regarding the environment have evolved, what this evolution has led to, and the U.S. Military's program for being good environmental stewards in our Area of Responsibility (AOR). It will close with some thoughts on potential ways ahead. In particular, how we might expand our environmental program to ensure a better future.

Until about 30 years ago, nobody except perhaps scientists even thought about the environment. It was simply not on our scope. We routinely dumped waste oil, solvents, paints, chemical, and other

pollutants on the ground and in our water. Through our inattention, we realized horrific unintended consequences through widespread use of herbicides and pesticides such as DDT and other toxic chemicals. We incorporated such things as asbestos in numerous products without knowledge of its effects on



Responding to Environmental Challenges in Central Asia and the Caspian Basin

human health. The exposure to this specific mineral product has resulted in thousands of personal injury lawsuits and widespread changes in how we protect personnel during the manufacturing and use of products. The use of lead, particularly as an additive for gasoline and paint until the mid-1970s, caused numerous health problems, particularly for children. The U.S. Military subjected its own personnel to such things as nuclear blast testing, Agent Orange, and more without knowing the effects of the exposure on human health.

Our lack of knowledge and concern for the environment resulted in contamination of millions of acres and numerous sources of water. Nearly every military base in the United States has environmental concerns. Use of some pesticides, such as DDT mentioned earlier, nearly caused the extinction of the North American Bald Eagle and other raptors. Military exercises and operations, if not properly planned and executed, can damage the environment by disrupting or destroying plant and animal life. This effect came to be known as maneuver damage. Accidental and intentional spills of what are now commonly accepted as

hazardous material, such as oils and other petroleum products (antifreezes, paints, pesticides, etc.) occurred on a daily basis throughout society.

Two specific examples of the difficulties and consequences of environmental disregard occurred at Aberdeen Proving Ground and Love Canal. At Aberdeen Proving Ground (an Army Test, Evaluation and Training Activity located on the Chesapeake Bay in Northern Maryland), the intentional disregard for Hazardous Waste handling and disposal in the late 1980s led the State of Maryland to file criminal charges against three individuals. Each of the three received felony convictions and was fined up to \$200K. This case led to a change in sentencing guidelines (now jail) for intentional violations of environmental laws. Base Commanders are personally liable for the activities on their bases (cost of defense not covered).





At Love Canal, commonly thought to be one of the most notorious toxic dumping cases in U.S. history, Hooker Chemical and Plastics Corporation buried 22,000 tons of chemical waste in shallow canals from 1942 to 1953. Later the city of Niagara Falls, New York, acquired the property and allowed a developer to build houses there. Within several years, many of the residents were experiencing significantly higher illness rates due to passive exposure to the buried chemicals. Ultimately tens of millions of dollars were spent evacuating the residents.

In spite of the fact that many of the initial concerns for the health risks created at Love Canal turned out to be questionable, this event caused a dramatic shift in how we regard the environment. The Love Canal situation led to the establishment of laws for the

protection of the environment and federal organizations such as the Environmental Protection Agency. It caused the establishment of “Environmental” departments in most federal and state agencies such as the Department of Defense, Department of State, and Department of Transportation. All military services have environmental branches and all military bases have environmental staffs. It also led to the establishment of the Hazardous Substance Superfund. It was established by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 to cover the cost of cleaning up facilities placed on the National Priority List. The fund includes both private and federal funds. The parties determined primarily responsible for the pollution must provide significant contributions to the Superfund.

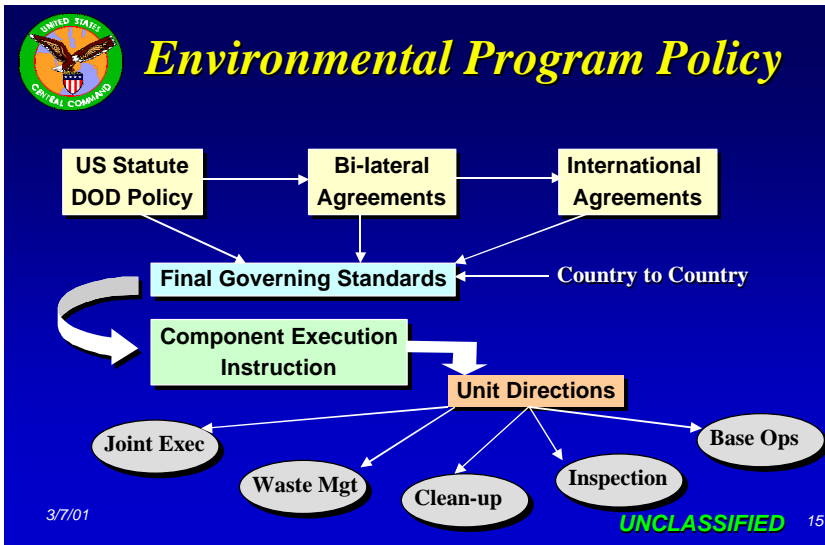


These kind of issues and significant environmental disasters like Three Mile Island, Chernobyl, and the DOW Chemical Plant explosion in Bhopal, India, raised awareness on Environmental concerns and caused a change of thinking. Environmental concerns are now a part of our normal operating procedure. For instance, environmental impact statements & studies are a necessary part of project development. Environmental clean-up is a large part of our work load with more than \$11 Billion spent on Superfund sites (only 498 of 1,405 sites completed) and more than \$20 Billion spent to date cleaning up military bases (includes Superfund).

It effects planning considerations for military operations and exercises. We must perform environmental assessment/surveys prior to commencing and upon completion of exercises. We

must include provisions for HAZMAT handling and HAZWASTE disposal during exercises and operations.

Since our change in attitude, we have experienced numerous successes and continue to work toward further improvement. Some examples follow. The U.S. Army and U.S. Air Force are actively working to eliminate hazardous materials from their inventory. One initiative has lead to elimination of TCE (a solvent), which cost \$500/bbl to buy, \$1-2K per bbl to test if contaminated, and \$2M/bbl to recover if spilled in ground water. It has been replaced with water-soluble solvents that are biodegradable. Camp Lejune, NC during the late 80's embraced environmental and endangered species concerns and built a training/range management program for identified areas. Efforts were so successful that conditions for plant and animal life actually improved and Marines were able



to buy an additional 40,000 acres for training.

The Green Bullet. The Army has looked at means of replacing the lead projectile with a non-lead bullet for use in areas where lead is a problem. The Army also has an active program to reduce/eliminate Cadmium and Chromate coatings on parts such as engine components. So far, elimination of chrome coatings on Armored Personnel Carrier components saves \$200K annually and saves \$4M on upgrade costs. Eliminating Cadmium on some helicopter engines parts saves \$2M per year. Plus eliminating these metals saves on other HAZMATs like arsenic used in plating. To recognize the significant impact and importance of these kinds of initiatives the Service

Secretaries have an annual program that recognizes installations, teams, or individuals in Natural Resources, Conservation, Cultural Resource Management, Environmental Quality, and Pollution Prevention. Last year, the Undersecretary of the Army for Environmental Security awarded 15. Eight of those awards went to Army installations and individuals.

Environmental concerns encompass Economic, Political, and Security interests. Environmental issues cross over boundaries, economic class, politics, and security. They affect everything from economic development and management of resources to population growth and regional stability. We must be concerned about the interdependency imbalance caused by natural resource

Responding to Environmental Challenges in Central Asia and the Caspian Basin

distribution and the possible withholding of certain resources as a weapon. The impact of Environmental Security affects all of us -- and our way of life.

Given the significance and importance of environmental issues and ramifications previously discussed, let us now examine how the U.S. Central Command addresses environmental issues in the Gulf Region. Within the U.S. Central Command AOR, we have an extensive environmental program. We have such a program for several reasons. First and foremost, it is required by law. We must satisfy DoD requirements such as the Overseas Environmental Baseline Guidance Document (OEBGD), which establishes DoD baseline guidance for environmental protection on DoD installations overseas. We must establish and then follow the Final Governing Standard

(FGS), an environmental guidance document for U.S. Forces unique to a particular country, or the OEBGD when the FGS has yet to be approved. Of the 25 countries in the U.S. Central Command AOR, we have FGSs for eight. These are Kuwait, Kingdom of Saudi Arabia, Qatar, Bahrain, Kenya, United Arab Emirate, Oman, and Egypt. All of these, except Bahrain and United Arab Emirate, have been recently updated and approved. The Bahrain and United Arab Emirate FGSs are currently being reviewed for approval. We want to prevent actions that could limit access. We want to be a "Good Neighbor" and be welcome in your country. We also want to respect the Host Nation's natural, historical, and cultural sites along with protecting their endangered species to include plants as we partner in defense and security issues.



Responding to Environmental Challenges in Central Asia and the Caspian Basin

The U.S. Environmental program is really one of engagement, which is an integrated process involving numerous parties.

The Host Nation is concerned with their own internal environmental, commercial, and cultural issues. The U.S. Federal Agencies are concerned with U.S. policy and impact on the other nations and the conduct of U.S. services. The U.S. Central Command is concerned with responsible environmental stewardship, compliance with higher authority, access, and operations in the AOR. The Service Components are concerned with day-to-day operations, being good neighbors, and protection of troops. All of this leads to the central concern of maintaining global health and ensuring a safe and clean environment now and in the future.

The complex integrated concerns for Environmental Engagement led to the U.S. Central Command environmental structure. The overarching area is strategy. The CCJ5 is responsible for establishing the U.S. Central Command environmental security strategy and environmental engagement plan. The CCJ4 has closely supported the CCJ5 to both establish and execute the plan. There are four broad sub-areas that

support the CCJ5 environmental security strategy:

- Oversight (Engineers and Plans) includes policy,
- Execution, and compliance management;
- Engagement (Plans) includes daily interaction and conferences;
- Information management utilizes various information services to track environmental concerns and natural disasters (Intelligence);
- Health concerns (Surgeon) including environmental health are the protection of personnel and environmental medicine.

Under oversight, the CENTCOM environmental program includes four major areas:

- Structure, the Executive/ Executing Agent responsibilities;
- Policy, the specific guidance that governs what we need to do and how;
- Execution, getting the job done; and
- Compliance management, ensuring our subordinate units execute their responsibilities.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

The U.S. Central Command is the Executive Agent for environmental issues in the AOR. The Executive Agent is responsible for oversight and compliance, and ensuring execution of the requirements. The Executing Agents are responsible for the execution of the environmental program governing U.S. operations in the AOR in accordance with DoD and CINC guidance. We have established Executing Agents in countries with significant, permanent U.S. presence. Executing Agents are also responsible for all U.S. personnel, U.S. assets, and U.S. occupied facilities in specific countries throughout the AOR and are assigned as indicated below:

- USAF: Saudi Arabia, Egypt, Oman
- ARCENT: Jordan, Kuwait, and Qatar
- NAVCENT: Bahrain, UAE, Kenya

As noted earlier, the policy portion is composed of U.S. law, DoD policy (such as the OEBGD), bi-lateral and international agreements and treaties, and host nation laws. All of these go into the development of an FGS which, once developed, prescribes the responsibilities and requirements for U.S. forces operating in a particular country. FGSs lead to Component execution plans, directives, and instructions. These are used to

develop unit level directives, instructions, procedures and policies. These are used to execute the day-to-day functions at the worker/planner level.

Under the execution area of our program, we focus on exercises, day-to-day efforts, land management, and inspections. For exercises, we develop Environmental Annexes to ensure compliance with U.S. and Host Nation laws and agreements. Annexes direct the completion of site surveys before and after exercises to ensure minimum adverse impact on the environment. They also direct coordination for hazardous waste removal and proper disposal during the exercise. The day-to-day efforts include managing and disposal of HAZMAT, running recycling programs, and maintain spill response teams. Land management must ensure protection of natural resources and protection of sensitive plant and animal species. Carrying out active inspection programs at unit and component level will ensure proper handling and storage of wastes.

Environmental concerns are an integral part of all base operations.

Under compliance, the U.S. Central Command Engineers work closely with our military components to ensure we are

being environmentally responsible while operating in the AOR. We work to make sure we follow the structure in complying with policy and execution. We have established an Executive Oversight Committee (EOC), Chaired by the U.S. Central Command Director of Logistics, to address environmental issues that could have significant impact on the command's environmental program, strategy, or U.S. National interests. The membership consists of each Component Chief of Staff and it meets semiannually. We also established the Action Officer Working Group (AOWG), chaired by the U.S. Central Command Environmental Officer, with membership consisting of each Component Environmental officer and a representative from Defense Reutilization Management Services International. The AOWG meets every six months to work on outstanding Joint environmental issues affecting

the U.S. Central Command AOR and supports the EOC. We also visit sites once per year after their External Environmental Compliance assessments to assess progress in correcting any findings of non-compliance. This program has been developed to ensure that environmental compliance is met.

As we look to the future, the U.S. Central Command will continue to refine its engagement program with more military-to-military contact throughout our AOR. Environmental Security provides an excellent engagement tool, which by addressing a common concern enhances our relationship and regional stability. We want to participate in follow-on Environmental Security conferences, with sharper focus on specific concerns of the sub-regions. This critically important issue requires our combined effort. Our children's children will thank us for it.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

RESPONSE TO THE TURKISH EARTHQUAKES



By Brigadier General Ali Fuat Sarac

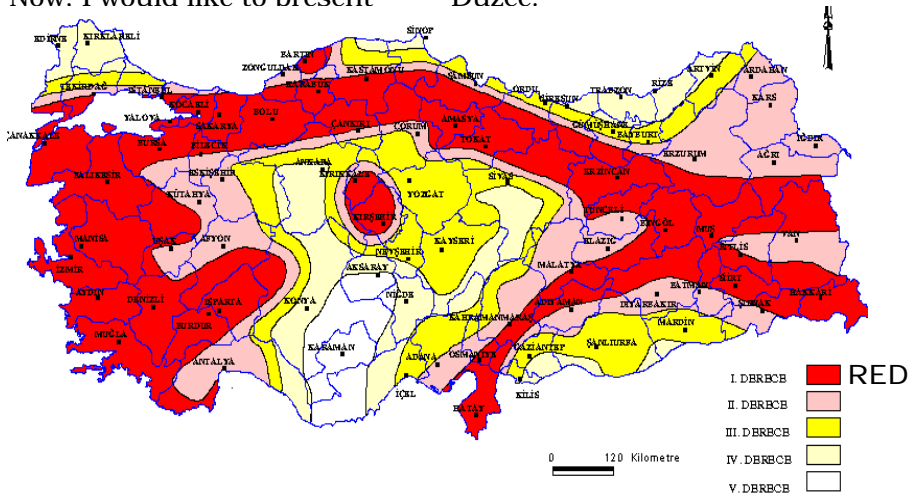
Distinguished participants, I would like to express my happiness to address all of you here. I would like to give my presentation under the following topics shown on the screen:

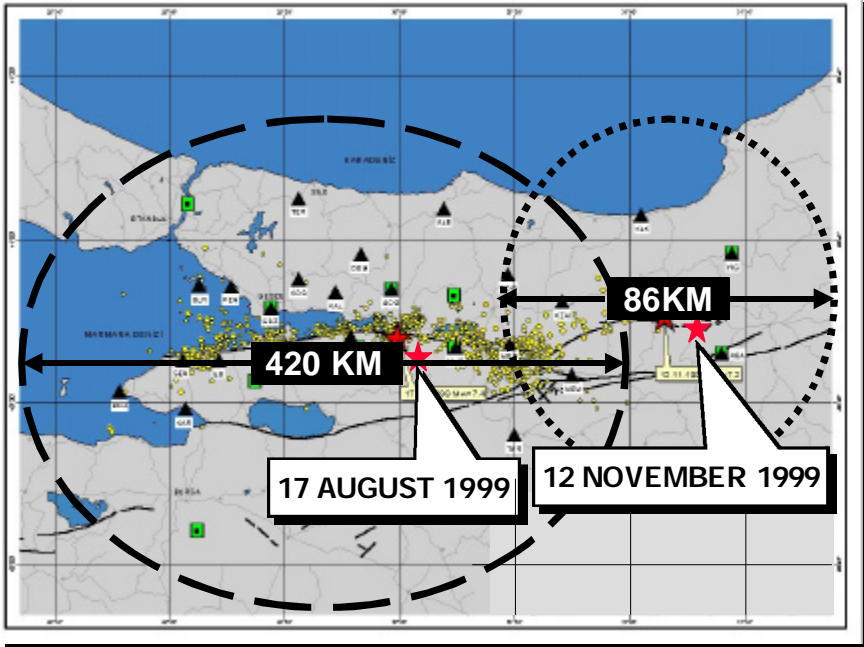
- General Matters,
- Activities Carried Out by Corp Commands,
- Lessons Learned by The Marmara (on August 17, 1999) and Bolu/Düzce (on November 12, 1999) Earthquakes,
- Important Activities Executed by TAF.

GENERAL MATTERS

As shown on the earthquake map, a great part of Turkey is under the risk of first-degree quake (THE REGIONS MARKED RED). Given the regions of second and third degree quake, it is obvious that Turkey is an earthquake country. Now, I would like to present

information on the earthquakes that occurred in Turkey in 1999. The first quake occurred in Marmara region on August 17, 1999 with a magnitude 7.4, epicenter of which was Gölcük and the other was in Bolu, Düzce and Kaynaşlı regions on November 12, 1999 with a magnitude 7.2 and epicenter in Düzce.





The movements of the Northern Anatolia fault line caused these disasters. These movements affected an area with a 420 Kilometer diameter during the quake on 17 August and an area with an 86 Kilometer diameter during the quake on 12 November.

As a result of both quakes 377,879 houses and offices were damaged; 18,243 persons died; and a total of 48,901 persons were injured. The area affected by the quake is about 100 square kilometers, in other words, larger than the total area of the Netherlands and Belgium combined.

ACTIVITIES CARRIED OUT BY CORP COMMANDS

Within the scope of activities that were carried out, I would like to share the information and experiences we have gained due to the services provided in the disaster area and give you brief information on the matters we deem necessary:

- Establishment and Assessment of Circumstances
- Communication Problems
- Transportation Problems
- Search & Rescue and Evacuation
- Medical Evacuation and Treatment
- Security
- Organization

- Logistic System
- Burial Actions
- Board and Lodging
- Press - Public Relations and Psychological Consultancy.
- Training
- Coordination Deficiency

Establishment and Assessment of Circumstances.

Following 17 August and 12 November quakes, considered among the biggest disasters of 20th Century, the size of the disaster and the damage it caused could not sufficiently be detected at the beginning. Only after the reconnaissance conducted by the corps commands with the help of helicopters, were the dimensions of the disaster fully understood.

Communication Problems.

Due to tremors and atmospheric events the earthquake initially caused, cellular phone and telecommunications networks broke down for eight hours. Initially, no contact could be made with some units and agencies, since the earthquake had also affected radios and the switchboard operators. Therefore, two-way flow of information could not be achieved.

Transportation Problems.

As a result of the fact that the people from both inside and outside of the disaster had unconsciously and without any control tried to escape from or reach the area in times most critical for the search and



rescue activities in the disaster area, the traffic on the main roads was blocked and the roads in the region were almost closed to the traffic in the first critical six hours. Security forces could not be present in sufficient numbers, on time and in place to assist with traffic flow for they had also been affected badly by the earthquake. As a result, the main roads and railways were not functional and maritime lines could not be used since the ports were also damaged.

Search, Rescue, and Evacuation Services.

Since the disaster region had covered a big area, the Regional Disaster Commands had been divided into sub-commands to commence the search and rescue activities. Since units did not have proper search and rescue equipment, they had to carry out rescue activities with simple tools such as diggers, spades, sledgehammers, wire-cutters and jacks. During the

search and rescue activities, rescue vehicles with small tracks, fire extinguishers and fire engines were required and other brigades from near regions were employed. The areas where search and rescue activities were carried out were secured in order to save human life against the danger of collapse of houses. So, additional safety equipment (marking sets) was required.

Medical Evacuation and Treatment.

Another point that deserves special attention in natural disasters is medical evacuation and treatment. For example, on the first day over 1,000 injured were evacuated by 37 helicopters to Bursa, Ýstanbul and Ankara. Although helicopters were the most required vehicles to transport the injured, waiting points for sick and injured persons and ambulances were established in certain centers due to weather conditions. In the first week after the





earthquake, Mobile Hospitals were established, but their capacity was not sufficient. Great efforts were made to keep proper records regarding evacuation of the injured and sick persons. Experts noted that the psychological disorders would further increase 6-7 months after the earthquake, therefore, measures were also taken in this regard.

Security.

The police, gendarmerie and armed forces were individually employed for order and security services. Foreign search and rescue teams were sent to places that required prioritized reaction.

Organization.

The organizational structure of the rescue teams and military units belonging to the state and

private institutions as well as non-governmental organizations were required to be improved in accordance with the activities to be carried out in disaster.

Logistics System (Acceptance, Record, Storage and Distribution Setting up and Management of the Logistic System).

Establishing and managing the logistic system was the most significant activity carried out following the earthquake. The fact was that there was significant assistance provided from both home and abroad from the first days of the earthquake. Understanding this, we rapidly established a computer-based logistic support system after the disaster. The aid materials in all of the storehouses in the disaster area were controlled and distributed to the citizens who needed them in a timely manner. Appropriate measures

were taken to prevent the food and bread from spoiling. The critical medical aid materials from home and sent from abroad in particular were used efficiently and effectively.

Burial Actions.

Due to the large number of deaths, cold stores and ice-skating fields in Kocaeli were used. The bodies had to be buried immediately since they threatened environmental health. In order to prevent future legal problems, however, three pictures were taken of each corpse, each was recorded on videotape, and their fingerprints were taken before they were buried in areas that the respective municipalities allocated.

Board and Lodging.

Temporary sheltering was one of the basic problems after that devastating disaster. Establishing the temporary shelters was completed in three stages.

- First Stage – At the beginning, tents were distributed for urgent sheltering needs. For this purpose, individual tent groups were formed in order

to meet the needs of the people whose houses were destroyed and who had to deal with their dead.

- Second Stage – In this stage, the individual tent groups were consolidated and new tents, which included infrastructures and super-structures (which were suitable for social life), were set up in appropriate areas. Moreover, we constructed places necessary for daily life such as kitchens, toilets, places for washing dishes and clothes, as well as bath and the other educational and social facilities.
- Third Stage – The activities were conducted for educating the quake sufferers living in tent cities and for normalizing their lives. Within the scope of these activities, libraries were opened and several artistic and cultural activities were organized. Several cooperating universities and agencies opened courses, and several conferences were planned and held.



Press - Public Relations and Physiological Consultancy.

In the disaster region another problem was experienced regarding press public relations and public information service announcements. People in the quake region had a tendency to believe fictitious news accounts rather than official announcements and scientific explanations.

Education.

After the activities carried out by Search and Rescue Teams, we assessed that they were deficient in training.

Coordination Deficiency.

Since responsibilities of agencies and organizations had not been clearly delineated, there were initially some

difficulties in coordination, but those deficiencies were resolved by making the necessary adjustments in a short time. Despite these negativities, Turkish Armed Forces (TAF) used all of its resources and met almost all the needs by making coordination with Prime Ministry Crisis Management. Its activities are listed as follows:

- 83 battalions and totally 64.000 personnel assigned in that region.
- 513 working machines of TAF were used in the Search & Rescue activities.
- In 12 tent cities, 5742 tents were set up and 25.754 people were settled.
- 9-Day Nurseries opened.
- 26 Mobile Kitchens set up.
- 164 Laundry Units set up
- 229 Bath Units were set up.

Additionally, the TAF met the electricity and water needs of the tent cities. It set up logistic support systems in provinces, towns and villages. Those systems were subordinate to two major logistic support bases in the quake region. They carried 5,473 personnel and 720 tons with 1,335 sorties. The TAF set up a transportation system to deliver the relief coming from inland and abroad. It established an air-bridge using aircraft and helicopters to evacuate the patients and the wounded. For treating patients and the wounded, the TAF provided medical service with its 71 expert doctors, 72 nurses, and 10 medical technicians in its two mobile surgical hospitals. Finally, the TAF set up a “Psychological Problems Research and Crisis Response Center” in order to treat the psychological problems of the disaster victims.

LESSONS LEARNED BY MARMARA EARTHQUAKES

Considering the effects of earthquake on our lives, our normal life was ended by the disaster. Search and rescue, board and lodging, and improving and normalizing activities became vital for us. However we recognized that it was vital to return to a normal life should as soon as possible. In order to mitigate the effects of the disaster and normalize the lives of people, there are a series of important measures:

- Measures taken before a disaster
- Measures taken during and after a disaster.
- Measures taken to normalize the lives of people.



MEASURES TAKEN BEFORE A DISASTER

- Establish Geographic Information Systems in the regions having high quake risk. These would include all data about settlement areas and would be continuously updated and used when necessary.
- Develop disaster response plans and establish response priorities and responsibilities.
- Educate people living in the regions having high disaster risk about proper responses during a disaster.
- Establish safe regions to which disaster victims would be evacuated. Construct appropriate infrastructure and store necessary materials for supporting evacuation.
- Planning should include assigning helicopter re-sources of the country, including the civil sector, to the disaster region as a priority. This would eliminate immediate transportation problems.
- Prepare sufficient and adequate helicopter landing zones in advance in

order to facilitate deployment of search and rescue teams by helicopter.

- Plan for equipment fuel use, maintenance, and an adequate number of operators to operate on a 24-hour basis.
- Link mine workers with other institutions during the search and rescue activities, to make use of their experience.
- Set up earthquake first-aid stations in the most densely populated regions. These stations should be equipped and manned to provide assistance to overcome the initial shock, provide first aid for families and neighbors, to extinguish small fires, and to rescue quake victim trapped in the ruins.



Responding to Environmental Challenges in Central Asia and the Caspian Basin

- Designate logistics areas in advance to facilitate establishment of distribution systems at possible earthquake zones. Open large storage areas suitable for the traffic of all kinds of vehicles.
- Plan temporary shelters to provide food in the week after the earthquake and to supply warm meals.
- Procure and store sufficient quantities of corpse bags, since initially it is difficult to find bags.
- Determine the areas on which the tent cities and prefabricated dwellings will be established in advance. Build required infrastructure and superstructure facilities, since this takes time. Procure and store winter tents, containers, and building materials.
- Search and rescue units should conduct and sustain

necessary training to address weaknesses.

PRECAUTIONS DURING DISASTER

- The first thing to be done in the event of an earthquake is to identify and assess the situation. Therefore, critical military personnel and public administrators should personally make surveys from the air and ground if possible (checking buildings and streets one by one). Information should be captured on sketches/maps by using Geographical Information Systems.
- Establish a single center to coordinate and channel the activities of rescue teams.
- Only specialized and well-trained teams should be employed in search and rescue activities.
- Many people from in and out





participated voluntarily in the rescue activities in 17 August and 12 November earthquakes. In some cases these people, in spite of their good intentions, caused more harm than good because of lack of training and equipment.

- The most critical period in search and rescue activities is the first 48 hours. The first foreign search and rescue teams, which may be primarily needed during this period, should be immediately transferred to the disaster area without following strict visa, passport or airline procedures.
- Search and rescue teams should be appointed based on a damage survey of buildings from the street.
- Foreign search and rescue teams should maximize use of portable equipment and

materials. This reduces the burden on the country undergoing the disaster.

- Requests for materials and donations should consider disaster the country's response plans as a basis and be a coordinated effort.
- The Armed Forces, Gendarmerie, and Police forces should be appointed to security zones for the provision of security and should be centrally controlled.
- Security of the disaster area should be provided while search and rescue activities are being conducted. People should not be permitted in these areas, unless they are essential to provide information to assist rescue workers. They should be isolated and sanitary teams should be ready and waiting for intervening the injured.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

- Effective traffic control should be ensured in the disaster area. As an immediate response, the fastest vehicle possible should first remove the debris on the main roads.
- The regional highways should be limited with regard to space and time and alternative roads should be planned.
- The disaster stricken should be immediately evacuated to a pre-determined region where they can recover from shock and where they can find board and lodging.
- In order to provide communication, earthquake special frequencies should be established and local radio broadcast stations should be used to inform the public and lead disaster units. Satellite ground terminals, carried by helicopters, should be used in disaster areas.
- The components that will support Search and Rescue activities should be capable of participating in search and rescue activities actively and continuously during two days without support.
- A fast evacuation system should be established. Land, air, and navy evacuation systems should be coordinated. Ambulance evacuation points should be established. Records of the ill and injured should be kept properly during their evacuation in order for the quake-stricken to find their relatives in the hospitals easily.
- People should not make the distribution and deliveries of aid through institutions and organizations other than through the established logistic system. Even though control is difficult, many distribution points should be established to facilitate quick distribution.



- Medical personnel, who are efficient, well-informed and who know a foreign language should be appointed for proper classification and distribution of aid. The aid should be included in logistics system and should be distributed after that.

- In order to limit confusion and misinformation, the news should be communicated to the press members as current developments by means of press and public relations agencies established in the disaster area.

- In order for the public not to be influenced by negative propaganda, true news and statements should be broadcast frequently from radio and televisions by official authorities.

- In order to facilitate the continuous flow of aid, establish an information system through the media that explains how aid is acquired and transferred to disaster victims.

- Within the scope of supporting psychological operation activities, personal needs of the staff that participate in the earthquake activities should regularly be met. Necessary precautions to boost motivation and morale should be taken. In order to

ensure comfortable and peaceful working conditions for state employees, spouses and children should be accommodated in special recreation centers away from the quake region belonging to the state.

NECESSARY PRECAUTIONS FOR A NORMAL LIFE

- Damaged infrastructure (such as electric lines, water distribution systems, drainage systems, and sewage systems) should be identified and repaired as quickly as possible.

- Necessary precautions should be taken to eliminate the negative psychological effects of the disaster on people. Rehabilitation Centers (public mental health centers) should be established and planned to serve at last for two years.

- Authorities should immediately start to construct new buildings that will enable people to transfer to permanent buildings from temporary buildings.

- In conjunction with these precautions, others such as tax decreases and enticements that may refresh the economy of the region and the country should be taken.

- The following services should be provided for quake victims

Responding to Environmental Challenges in Central Asia and the Caspian Basin

after the disaster to lessen the effects and accelerate the process of returning to a normal life.

- ✓ Communication services
- ✓ Transportation services
- ✓ Disaster relief and debris removal services
- ✓ First-aid and medical services
- ✓ Preliminary damage-establishing services and temporary housing
- ✓ Security services
- ✓ Burying services
- ✓ Educational and cultural services
- ✓ Infrastructure services
- ✓ Rehabilitation services
- ✓ Permanent Houses for the people lost their homes

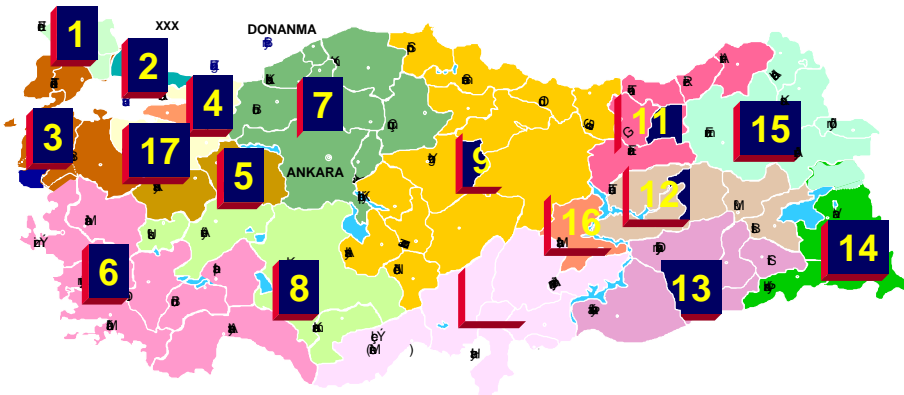
IMPORTANT ACTIVITIES EXECUTED BY THE TAF

The TAF has taken a series of precautions as a result of these disasters and reviewed its structure to mitigate damage when faced with a probable disaster.

As shown in the figure below, the TAF established 17 Disaster Area Commands. Within this organization, it established three intervention forces.

- Emergency (first) Echelon Force
- Second Echelon Force
- Third Echelon Force

Emergency (first) Echelon Force. These are units with special training and equipment. They are deployed in the centers and are ready to deploy by air to the disaster area within three hours. These elements are specially equipped and trained to respond to natural disasters immediately. With regard to combat and movement capability, they are self-sufficient which can reduce the atmosphere of panic and fear of disaster victims. They transfer disaster victims to certain areas to provide for their security and where they can be provided the services of first aid, medical transfer and treatment.



Second Echelon Force. These are units that can deploy within six hours. These units are the size of medical service Forces. They have the capability to provide rescue, emergency aid and transfer, security, temporary board and lodging, and medical services.

Third Echelon Force. These are those with special equipment, machinery, and training, which can deploy to the disaster area within 12-24 hours. These elements are as follows:

- Construction units
- Quartermaster units
- Transportation units
- Civil-military cooperation units
- Psychological Operation Units

Finally, I would like to provide you in formation about the TAF Natural Disaster Search and Rescue (DSAR) Battalion, which has completed its certification and is ready for service at any time as a first intervention force. The organization structure of the unit is as can be seen to the right. Its personnel are specially trained and equipped with modern

equipment. The main training branches are:

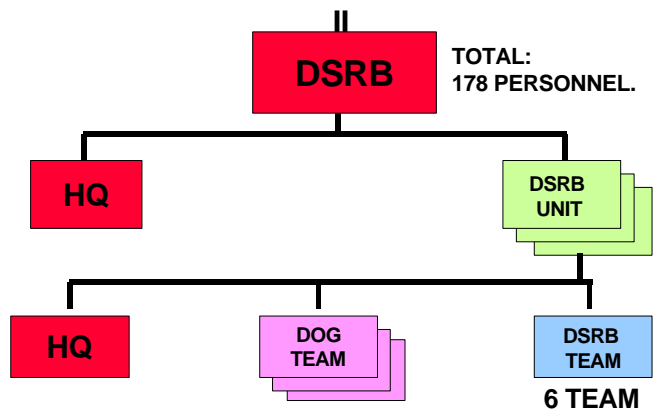
- Search and Rescue (Naval and Land)
- Avalanche and Mountaineering
- Nuclear, Biological, and Chemical (NBC)
- Flood
- Earthquake
- Fire

Moreover, teams similar to this element within the forces were established (DSAR Teams) and activities within this scope still continue.

CONCLUSION

In conclusion, I would like to express my gratitude on behalf of Turkish Nation to the countries that did not avoid helping us sincerely and gave their immense support during our painful days.

DISASTER SEARCH- RESCUE BATTALION



Responding to Environmental Challenges in Central Asia and the Caspian Basin

**CHAPTER 5 – *National Focus: Military Response
& Support to Civilian Authorities***

Panel Moderated by Rear Admiral Gaidis A. Zeibots

Hurricane Mitch Scene Setter
Dr. William Bertrand

Disaster Response Planning
Mr. Wolfgang Krajic

Military Support to Civilian Authorities
Colonel Bruce Bodin

*Military Medical Support to Environmental Security
and Disaster Response*
Commander Michael J. Sircy



Responding to Environmental Challenges in Central Asia and the Caspian Basin

NATIONAL MILITARY RESPONSE AND SUPPORT TO CIVILIAN AUTHORITIES



By Rear Admiral Gaidis A. Zeibots

When disasters threaten a region, local responders, government agencies and private organizations take the action. Their goal is to save lives and help people cope with chaos. They have the skills and equipment to do the specific job, but sometimes need help from the State. Mostly, this assistance is financial, but sometimes the State provides support with military units and equipment. In this case, there are special decision-making processes as well as command and force structures. In general, Latvia has prepared a system, which supports the actions that deal with disasters. These special structures not only respond to disasters or terrorists, but also are part of our warfighting forces. The primary reason for that - National Armed Forces have this mission and have prepared operational plans for military support to civilian authorities.



Situation Assessment

Geographically, Latvia is located in the northern part of Europe. Normally there are not hurricanes or earthquakes, but there

can be wildfires, floods, extreme freeze or snowstorms. For such cases, military and special National Guard resources are required to supplement state response efforts. There is also some involvement of military resources in response to environmental incidents (for example incident in nuclear power station in Lithuania), civil disturbances, or mass immigration. Military support is possible in counter terrorism operations. In all of these cases, we use a crisis management center for command and control. The initial response is from local emergency service personnel. When the local

capability is insufficient, the local government calls the state authorities.

Crisis Management System

A typical range of threats for Latvia could include:

- Economical and financial instability;
- Border management and refugees;
- Organized crime;
- Natural disasters;
- Environmental threats;
- Terrorism.

The purpose for establishing a crisis management system is to ensure national security and contribute to international stability and security. The specific goals are to:

- Integrate the activities of public institutions engaged in the management of crisis situations in different spheres, especially in the areas of crisis detection and prevention, into a single system;
- Ensure timely civil and military preparedness for every crisis situation;
- Prepare mechanisms of efficient crisis management.

The crisis management system should carry out the following tasks:

- Ensure that government authorities are provided prompt information analyses and forecasts –

these are vital to crisis prevention;

- Continue preparation of the integral infrastructure necessary for the functioning of the crisis management system;
- Have managing agencies and procedures prepared for crisis management actions and operations;
- Ensure international cooperation in crisis prevention and management spheres.

The goals of the crisis management system are identification of risk factors and threats as crisis situations develop and throughout actual crises. The main elements of the system performing the function of forecasting risk factors and threats are established in the state crisis management center on the basis of the joint activities of the ministries and other institutions. National crisis management authorities are the President of Latvia, Government, Parliament, the National Security Council and inter-ministerial Crisis Management (CM) Staff. There are six (6) persons in CM staff in Latvia. The Chief of Crisis Management Staff is directly subordinate to the Prime Minister. This close integration with the executive is key to successful crisis management.

Military Support

The main political priorities for Latvia are joining NATO and EU. The main task for the Latvian National Armed Forces is to prepare to be the best possible candidate for NATO/EU membership by:

- Developing self defense capabilities;
- Developing interoperability with NATO/EU forces;
- Providing forces for peace support operations;
- Improving national armed forces capabilities to provide assistance for civil society in peacetime.

This is a base for preparing units and structure for special missions in crisis situations. Every service staff has personnel for coordination with local government. Military support will be available only after invocation and special resolution of Cabinet of Ministers. The Ministry of Defense evaluates all civil authority's requests for military support. Requests must meet the following criteria:

- Legality,
- Risk,
- Cost,
- Appropriateness,
- Readiness of units.

The Minister of Defense established priorities and determines what military resources will be made available

for support. The unit commanders ensure that these resources are used judiciously by adhering to the following principles:

- Civil resources are applied first in meeting requirements of civil authorities;
- Military resources are provided only when response or recovery requirements are beyond the capabilities of civil authorities;
- Specialized capabilities are used efficiently;
- Military units shall remain under military command and control;
- Military components shall not perform any function of civil government unless absolutely necessary and then only on a temporary basis under conditions of immediate response;
- Military missions will have priority.

The *first responders* are the local rescue and fire service, state and municipal police, medical services. Local emergency services organize their response at the incident scene using the incident command system. This system is a flexible for one or more agencies to coordinate and combine independent efforts in an effective and efficient response. It provides a reasonable span of control, uses

common terminology, is action oriented, is supportable by other operational centers, and provides one commander for incident.

The *incident commander* (commander on scene) is normally the senior responder of the organization with the preponderance of responsibility for the event (fire chief, police chief, emergency medical). The incident commander system provides for unity of command. Effective local response depends on the coordinated efforts of various departments and agencies. The incident command system is the framework for coordinating emergency response personnel – including fire fighters, police, health department, environmental officials, law enforcement. The incident command system sets a common standard for emergency response organizations and includes common terminology (names for functions, terms for actions, titles for personnel), a top down structure, and integrated communications (communication plans, use of plain language).

The commander-on-scene establishes an *incident command post*. All operations are directed from this post. The crisis management center supports and complements the incident command post. The

incident command post operates in four major functional areas:

- Planning,
- Operations,
- Logistics, and,
- Finance.

According to Latvian law and regulations, National Guard units operate under military command at all times. They can be used for law enforcement in accordance with the law. In crisis situations, the five National Guard regional command centers are available for use as incident command posts.

The decision to activate the crisis management center is made by the National Security Council (NSC) after a situation assessment. The first step for activating is deployment of a special interagency team. This team provides advice to the commander on scene and additional information to NSC. When the situation requires, the crisis management center will deploy. The crisis management center continually assesses intelligence and reports; it is the nerve center for interagency coordination and decision-making. When the situation dictates and the crisis center requires support from the Ministry of Defense during crisis management operations they will ask the Ministry of Defense to provide special mission units.

Baltic Cooperation

Intensive Baltic defense cooperation is the basic foundation of Latvia's security elements, as well as a factor for NATO/EU interoperability. The Operations Concept states that a threat to one of the Baltic States is a threat to them all. To accomplish the above stated goal the National Armed Forces have participated in developing a lot of cooperation projects. The main goals of these projects are:

- To provide an investment in development, modernization to increase the capabilities of Baltic security;
- To increase the interoperability of Baltic armed forces with NATO/EU forces;
- To provide a system to ensure optimal use of existing Baltic defense resources;
- To develop peacekeeping capabilities within the Baltic Armed Forces.

To achieve these goals the following joint projects have been established:

- A joint infantry battalion (BALTBAT);
- A regional air space surveillance system (BALTNET);
- A joint Naval Forces squadron (BALTRON);

- A joint senior officers education and training system (BALTDEFCOL).

Latvia will continue to fulfill its obligations with regard to these projects and, together with the two other Baltic States, develop new projects. This is fundamental for cooperation on day-to-day base and important instrument in crisis situation. Baltic States have a number of agreements, which facilitate supporting one another in different situations (e.g., border crossings).

Summary

A crisis management facility is a national asset and not the asset of any one agency or ministry. To avoid inter-agency rivalry, cooperation is essential. The links between military, the civil authorities and the population must be strong. Militaries must remember - *they are part of society, they are working and serving their country*. They must take part when the country is in need, but it must be in conformity with law and state regulations.

HURRICANE MITCH



By William Bertrand and Eric Knefick

Hurricane Mitch was an event with a major impact on the way disasters are managed in the Americas. There have been a large number of studies of this Hurricane commissioned by numerous different entities. One cited over 600 references in its bibliography (Lidy et. al., April, 2001). It focused specifically on the role of the military during and after the hurricane hit. As the most studied disaster phenomenon to have impacted the Americas in many years, the circumstances surrounding Mitch, and the way in which the world managed its response, provides an interesting and useful case study for helping to understand the role of the Military in disaster response.

Our case study is organized in the logical order of events. First, where, what and when did the storm hit.

The Path of Mitch

According to the US National Environmental Satellite Data and Information Service, Hurricane Mitch began as a tropical depression that formed in the southern Caribbean Sea on October 21, 1998. The next day the depression became a tropical storm named "Mitch" but moved very little, remaining due east of the border between Costa Rica and Nicaragua. Between October 23 and 26, Mitch strengthened from a tropical storm with 70 mph winds to a Category 5 hurricane with winds of up

to 175 mph, moving slowly to the northwest towards the northern coast of Honduras. During this time, the winds reached a peak of 180 mph, making Mitch the strongest hurricane in the Caribbean in more than a decade.

By October 28, the winds associated with Hurricane Mitch had decreased to 120 mph and the storm was drifting to the west, just north of Honduras. The main threat of the storm at this time was not wind, but rain. The slow moving storm had already caused much rainfall throughout Central America but with the hurricane stalled off the coast, the rains increased in intensity and coverage, especially in



Figure 1. The path of Hurricane Mitch.

Honduras and Nicaragua, causing wide-spread flooding and mud-slides.

Mitch was downgraded to a Tropical Storm on October 29th and made landfall in Honduras on the 30th, passing through the center of the country to the border of El Salvador. From there, Mitch moved northwesterly into Guatemala, bisecting the southern Pacific region and affecting northern

Guatemala and Belize before crossing the Yucatan Peninsula into the Gulf of Mexico.

The Effects of Mitch

The UN Joint Disaster Response and Recovery Mission to Central America reported that the hurricane affected most of the population of Honduras and Nicaragua; large tracts of El Salvador and Guatemala and had lesser impacts on Belize and Costa Rica. Not only were

thousands of people killed and missing, and millions displaced from the impact of the storm, the destruction of housing, agriculture, health infrastructure, schools, highways, bridges and water and sewerage systems was on an unprecedented scale.

The poorest and most vulnerable segments of the populations suffered the most from Mitch, mostly due to rampant poverty, rapid urbanization and lack of access to land, all which seriously intensify the vulnerability of the population

to these natural hazards. Poverty has left large numbers of subsistence farmers and semi-urban populations to lack access to adequate land, credit or technical assistance, and thus has forced them to live in high-risk marginal areas. From there, large-scale deforestation and inappropriate farming practices, particularly the cultivation of marginal lands without soil conservation measures and adequate watershed management, has exacerbated the vulnerability of much of the region.

Table 1 – Summary of damages by country (source: ECLEC)

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>HONDURAS:</p> <ul style="list-style-type: none"> ▪ 100,000 people displaced ▪ 100,000 people killed ▪ 100,000 people injured ▪ 100,000 people missing ▪ 100,000 people homeless ▪ 100,000 people unemployed ▪ 100,000 people without access to land | <p>NICARAGUA:</p> <ul style="list-style-type: none"> ▪ 100,000 people displaced ▪ 100,000 people killed ▪ 100,000 people injured ▪ 100,000 people missing ▪ 100,000 people homeless ▪ 100,000 people unemployed ▪ 100,000 people without access to land |
| <p>EL SALVADOR:</p> <ul style="list-style-type: none"> ▪ 100,000 people displaced ▪ 100,000 people killed ▪ 100,000 people injured ▪ 100,000 people missing ▪ 100,000 people homeless ▪ 100,000 people unemployed ▪ 100,000 people without access to land | <p>GUATEMALA:</p> <ul style="list-style-type: none"> ▪ 100,000 people displaced ▪ 100,000 people killed ▪ 100,000 people injured ▪ 100,000 people missing ▪ 100,000 people homeless ▪ 100,000 people unemployed ▪ 100,000 people without access to land |

The Response to Mitch

Due to the hurricane's slow development in the southern Caribbean, there was time for disseminating early warnings of both the intensity and dimensions of Mitch even though the exact path of the hurricane remained erratic and unpredictable throughout. Nevertheless, it appears that in all four countries, warnings were delayed or underplayed despite the mounting meteorological evidences of the storm's growing intensity.

The US Government Response

The earliest recorded response to Hurricane Mitch by the US government came on October 23rd, when the US Chargé d'Affaires to Costa Rica declared a disaster due to the severe flooding from the hurricane which was, at the time, located to the east of the country. The following information outlines the US government response by country as found in USAID Hurricane Mitch Fact Sheet #22 - December 23, 1998

- *Honduras:* On October 27th, the U.S. Ambassador to Honduras James F. Creagan declared a disaster due to the impacts of Hurricane Mitch. On that same date, USAID/OFDA (Office of Foreign Disaster Assistance) Disaster Assistance Response Team (DART) was established and USAID/OFDA response activities began.
- *Nicaragua:* On October 29th, U.S. Ambassador to Nicaragua Lino Gutierrez declared a disaster due to the catastrophic flooding. On that same date, USAID/OFDA DART was established and USAID/OFDA response activities began.
- *Guatemala:* USAID/OFDA pre-positioned disaster relief personnel in Guatemala on October 27th and a total of five DART members operated in the country until December 11th. On October 31st, Ambassador Donald J. Planty declared a disaster for Guatemala, and USAID/OFDA response activities began immediately.
- *El Salvador:* Ambassador Anne W. Patterson declared a disaster in El Salvador on November 1st. On that same date, USAID/OFDA DART was established and USAID/OFDA response activities began.
- *Belize:* The Government of Belize established an Emergency Operations Center to prepare for the storm's arrival and evacuated over 75,000 people from Belize City and the coastal

areas to temporary shelters in Belmopan. Contrary to initial forecasts, the hurricane did not directly strike Belize. On October 29th, US Charge d'Affaires Joel Danies declared a disaster for Belize due to the impacts of Hurricane Mitch. In response, USAID/PFDA immediately provided \$25,000 for the local purchase of food for distribution to displaced populations inhabiting emergency shelters. A four-person USAID/OFDA assessment team was in Belize from October 29 to October 31.

The dates of disaster declaration follow the path of the hurricane through the region. However, there is confusion as to exactly when the DART teams were established and activated. USAID Fact Sheet #22 states that OFDA *established* the DART Team on October 29th while USAID Fact Sheet #4 states that the DART Team was *activated* on November 2nd. Regardless, it appears that the earliest response by the US Government to the Hurricane was from the 500 troops stationed at Soto Cano Air Force Base in Honduras. According to the Interim Report of SCSCG, (March 1, 1999) the troops began relief operations even before the rains stopped and began to visit settlements in order to deliver medical care

as soon as transportation was possible. As a result, US Southern Command (SOUTHCOM) established Joint Task Force Bravo at Soto Cano to assist the people of Honduras, which was the country hardest hit by Mitch. There was other regional support from Howard AFB in Panama, which sent eleven 24th Medical Group personnel to the Medical Element at Soto Cano AFB in Honduras on November 2nd.

The White House, Office of the Press Secretary stated on November 5, 1998 that US SOUTHCOM began search and rescue and aid distribution missions in the region on October 31st, with forty-eight rotary and 25 fixed-wing missions already completed.

Once disaster was declared in Nicaragua (Oct. 29th), USAID/OFDA responded by providing \$25,000 for local purchase of relief supplies such as medicine and food. USAID/OFDA deployed a Regional Advisor on the 31st to assist with assessment and response activities with a Miami-Dade disaster specialist arriving on November 2nd. In addition, two US DOD Blackhawk (UH-60) helicopters and one Chinook (CH-47) were dispatched on the 2nd to assist with search and rescue activities. A shipment of relief supplies arrived on 3 November.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

According to SOUTCOM, a Miami-Dade disaster specialist was in El Salvador November 1st to assist USAID/OFDA/LAC in coordinating initial relief operations. On November 4th, USAID signed an agreement with the Government of El Salvador (GOES) providing \$25,000 in immediate assistance which were used to purchase supplies and equipment to support a national damage assessment by the National Emergency Coordinating Committee (COEN). On 5 November, OFDA airlifted relief supplies to El Salvador and coordinated the use of eight CH-47 and four UH-60 helicopters from Joint Task Force-Bravo, based in Honduras, to facilitate their relief efforts.

Joint Task Force-Aguila began deployment in El Salvador on November 12th, to assist with relief and rehabilitation activities in El Salvador, Nicaragua and Guatemala. By November 18th, two USAID/OFDA DART members were based in San Salvador to assist in the ongoing assessment of relief needs and priorities.

Timing of Response

Warning Phase: The First Steps

The earliest recorded response to Mitch was on October 23rd when the US Embassy in Costa Rica declared a disaster due to the rains produced from the tropical depression due east of the country in the Caribbean. Press releases

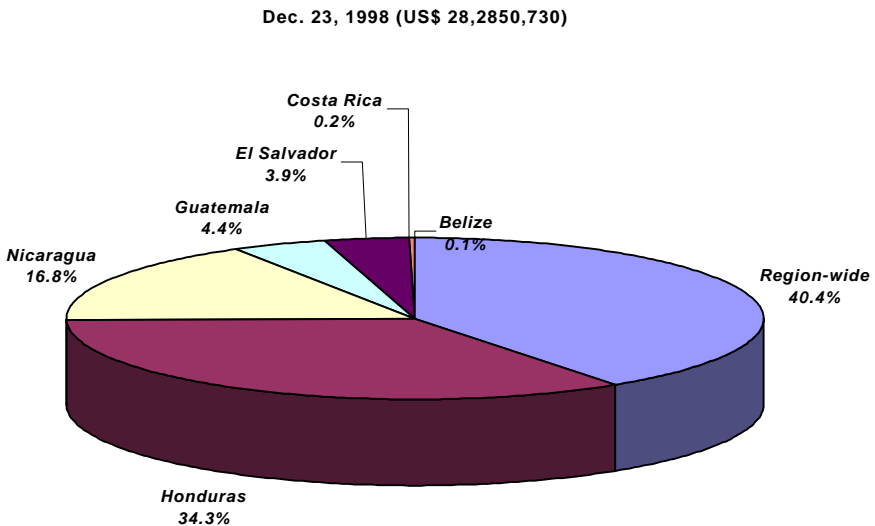


Figure 2. USAID/OFDA Funds for Mitch Relief

from ReliefWeb show that by October 25th all Red Cross branches throughout the Honduras were on alert and participating in evacuation and the distribution of relief items. The International Federation (IFRC) was also busy with coordinating and preparing the region for Mitch. On October 26th, the first meeting of a UN Disaster Management Team (DMT) took place in Honduras, as Mitch hit the Bay Islands.

By the time Mitch was upgraded to Category 5 hurricane status on October 27th, the US Embassy in Honduras had declared a disaster and US government assistance to the region had begun. In addition, reports from ReliefWeb indicate that the NGOs Adventist Relief Agency (ADRA) and Church World Service (CWS) were busy with evacuations and establishing emergency shelters in Honduras. The next day Mercy Corps International (MCI) was also fully active in assisting the first victims of Mitch in Honduras while the World Health Organization (WHO) was meeting to prepare a regional plan of assistance. On the 29th of October, the US Embassies in Nicaragua and Belize declared a disaster for those countries.

*Emergency Phase: October 30-
November 6, 1998*

The European Commission cleared humanitarian aid worth ECU 400,000 for victims of Mitch on October 30th, as Mitch made landfall in Honduras. The aid, managed by ECHO, was used by the Red Cross (Germany) to work with the Honduran Red Cross for emergency relief. On the same day, CARE International, in cooperation with the Ministry of Health, began providing affected communities with beds and blankets, powdered milk and crackers, and chlorine to purify water.

Disaster was declared in Guatemala on October 31st and the next day, while Hurricane Mitch crossed Guatemala, El Salvador declared disaster. Following an evaluation mission, teams from Médecins Sans Frontières (MSF) began assisting the victims of hurricane Mitch on November 1st in five regions of Nicaragua. By the time Mitch passed into Mexico and crossed the Yucatan Peninsula on November 2nd, the Pan American Health Organization (PAHO) was conducting an emergency health assessment in the region and UNDP had begun organizing relief operations for the UN system. On the 3rd of November, the

Canadian government announced intentions to provide humanitarian assistance to victims of the hurricane while the World Bank offered to restructure existing projects to provide immediate financial assistance to those Central American countries. In Nicaragua, ADRA had begun distributing chlorine for purifying muddy flood water and delivering military-type water bladders for clean water. Also on that day, the UN World Food Programme office in Honduras submitted an EMOP for 6 days of emergency food baskets for affected populations.

On November 4th ReliefWeb reported that Christian Aid organization was providing food and shelter to homeless in Honduras and Nicaragua while the Troicair (Ireland) relief operation began work in Honduras. On the same day the World Bank announced initial emergency recovery assistance for areas affected by Hurricane Mitch in Nicaragua and the European Commission cleared a package of humanitarian aid worth ECU 6.8 million for Central American countries struck by Mitch.

More UN relief efforts were in effect by November 5th, including an EMOP for 30 days of food for affected populations in Honduras and two weeks of

food for affected populations in Nicaragua by the World Food Programme and \$20,000 of medicines and 500,000 sachets of ORS to Nicaragua by UNICEF. In Honduras, UNICEF supplied food, water, drugs, and blankets and also presented Belize with \$36,000 for families in need. The Mennonite Central Committee (MCC) purchased 60 tons of rice, beans and corn in Belize for shipment to Honduras on November 5th. In addition, the World Bank announced a series of immediate actions to support emergency disaster relief efforts in Honduras by making available funds from a recently approved \$45 million loan for the Social Investment Fund Project (FHIS IV) to meet communities' needs for emergency rehabilitation of basic infrastructure services in rural areas affected by the floods.

By the last day of the Emergency Phase, Family Health International was active in the provision of food and emergency medical assistance in the region while World Vision staff distributed more than 2,000 survival packs in Honduras. The same day, Catholic Relief Services (CRS) had begun to distribute over \$700,000 worth of medicines to clinics serving the affected population in Nicaragua. It was also announced on the 6th that ADRA was acting as

the receiving organization at the Managua airport for USAID food shipments to Nicaragua and was working with Save the Children and Project Concern International to truck the food to desperate areas within hours of the plane's arrival.

*The Rehabilitation Phase:
November 7 - December 31,
1998*

Much additional assistance arrived once the initial Emergency was over and damage assessments were reported. As noted previously, Honduras and Nicaragua were damaged the most by the hurricane, mainly by flooding and mudslides which resulted in complete disruption of water and sanitation systems, damage and destruction of dwellings, roads and bridges, in addition to injury and loss of life. The main needs were shelter, food, water and medicine but access to the affected populations was a problem.

During this period, bi-laterals were providing support in many ways - through provision of military transport (helicopters), medical, veterinarian and environmental teams, and through debt forgiveness. These governments were also providing financial support for the procurement of relief supplies,

which were then distributed by NGOs, churches and other humanitarian organizations already in place in the region.

On November 7, the Australian Government pledged to provide \$500,000 through Australian NGOs that have ongoing activities in the region and \$250,000 to the International Federation of the Red Cross to assist with the provision of basic health care for a total of \$1 million. The next day, German Foreign Minister Joschka Fischer announced an increase in emergency aid to the countries devastated by Hurricane Mitch and said the government was considering canceling their debts. ReliefWeb noted that on November 9, Lutheran World Relief acknowledged the cooperation of church aid agencies in Holland, Switzerland, Germany and the United States in assisting 70,000 hurricane survivors with food at a cost of \$600,000. Also on that date, International Medical Corps (IMC) announced its deployment of an emergency health team to Honduras while Japan's government sent a 16-strong advance team to Honduras to assess the need for army medical officers to be dispatched overseas. Additional assistance (\$9.15 million) was provided by the Canadian International

Development Agency (CIDA) to fund relief efforts through the World Food Program, PAHO, IFRC, Oxfam Canada/Oxfam Quebec, CARE Canada, and the Canadian Embassies in Central America. World Vision announced that Voortman Cookies Ltd of Burlington donated 3,000 cases of fortified granola biscuits to be flown to Central American that day.

Cuba announced on November 10th that it would forgive the \$50.1 million dollars Nicaragua owes to Havana, and said it would offer medical assistance to Central American nations devastated by Hurricane Mitch. The United States also announced the provision of an additional \$10 million to the region while the Spanish government approved a 100 million dollar aid package to Central American countries hit by Hurricane Mitch and was considering canceling those states' debt. Also on the 10th, France announced it was canceling bilateral debt owed by Central American countries and was looking to pick up those states' debt repayments to the International Monetary Fund.

By November 10th, the World Bank was fully involved in its relief efforts to the region by announcing it was already making available about \$200

million from existing projects to assist the Central American countries devastated by Mitch. For Honduras, the Bank made available about \$100 million for immediate emergency and reconstruction needs. For Guatemala, the Bank announced plans to disburse \$21 million from four projects. For Nicaragua, a total of \$60 million was made available in addition to \$45 million equivalent credit to help finance the Third Social Investment Fund (FISE III) in Nicaragua to support the Government of Nicaragua's poverty alleviation efforts as well as its immediate emergency and reconstruction needs in the wake of Hurricane Mitch.

The immediate response to Mitch was major and the US military under the leadership of the Commander-in-Chief (CINC) USSOUTHCOM, General Wilhelm moved decisively and professionally. This response did much to legitimize and to bring to the fore the positive role of the US military in sudden onset disasters. In looking at the lessons learned however from the perspective of the different phases of the disaster the review is more mixed.

Lessons Learned

First, in the warning stage of the hurricane there was

clearly a huge amount of information in the system. Much more information was generated than could be coherently communicated to the potential impacted communities. In addition, the source of many of the problems was flooding, which was not well understood in the early warning stages. As a result, the continued and torrential rains rapidly produced much more water than the watershed could handle with severe impacts.

This underscored the second part of the problem, which was that local communities were not well prepared. It had been many years since a major storm had hit the region and there was little at the local or even the national level to organize for an event of such magnitude. In particular, the international agencies showed a lack of coordination. The role of UNDP, as the coordinating entity for the response, was poorly articulated with a resultant relative slow reaction time. Clearly improved coordination for Geographic Information Systems and local early warning and communication systems was an issue. In the time following the hurricane's impact many of the shortcomings have been addressed and new activities or project's undertaken to improve community level reaction, community military

coordination and an approach to data mining and summary reporting which has improved the state of readiness. The test will be the next big storm.

The emergency phase of the operations was characterized by the following set of summary observations drawn from secondary sources and individual interviews with key actors.

- ✓ Lack of integration efforts and risk assessment
- ✓ Red Cross, churches and PAHO best prepared
- ✓ Local authorities & civil defense then mobilized
- ✓ Overwhelming presence of international teams
- ✓ Logistic faults
- ✓ Initial assessment based on faulty information systems
- ✓ Capital Cities controlled initiatives
- ✓ Late detailed assessments
- ✓ Uneven search and rescue operations
- ✓ Response based mainly on ad-hoc improvisations

While much could be detailed on each of these points the general trend is similar in most large scale disaster responses. The issue is a straight-forward one: Central America had not been hit for

many years by a major multi-country event and it was simply not prepared. The scope and duration of the event covered too much territory for a coordinated response effort. As a result, problems arose at every level. These findings were stated even more strongly in the Lidy, et. al., report (“Effectiveness of DoD Humanitarian Relief Efforts in Response to Hurricanes Georges and Mitch”) which had as its first conclusion the following statement: “The US Inter-agency response system for large scale foreign disasters, within which DoD relief operations are embedded, is fundamentally flawed. The USG foreign disaster response system requires fundamental reform, for which the domestic Federal Response Plan provides a useful model.” (p. ES10.)

We believe that from Mitch a list of required responses can be generated which flows from the needs and problems cited above. Some of these events have taken place in the time span since Mitch others remain to be implemented. One clearly positive effect of Mitch was to stimulate USG agencies to act in a coordinated fashion. The UN and related NGO/PVOs also have made major changes in operational planning based upon the Mitch events.

Requirements for Improved Recovery Implementation.

- Provision of plan and information as soon as possible to all potentially impacted parties.
- Detailed definition of capabilities available to all.
- Definition of chain of command including medical issues.
- Provision of sufficient transportation and a system to prioritize the use of same.
- Utilization of Internet, GIS and other information systems to facilitate communication.
- Training on how to conduct assessments at all levels.
- Advance identification of organizations’ suitability to assist in emergency phase efforts.
- Link teams & efforts early on based upon pre-established information.
- Obtain information and make it available for all who are participating rapidly.

Again the above list is not exceptional in that almost of all of the points could have been made of many circumstances where disasters have hit in the past. What is important is that these issues have been recognized and

reacted to in multiple ways through OFDA, the DoD and just about every agency or entity that was involved with Mitch. In many ways Mitch was one of the first major disasters where all elements from reporting and communication to coordinating response were impacted by the linked telecommunications and media of a rapidly globalizing world. In summary, our conclusions are that there are key areas which need to be continuously monitored and reviewed to improve as much as possible our response to regional disasters such as Mitch. They are:

- Information management remains a great constraint to effective planning and should be carefully monitored and planned for at the earliest stages. A formal information audit directed towards disaster issues should be initiated in any at risk environment.
 - Planning activities must encompass preparedness, mitigation, response and recovery. The last few years have seen a blending of the disaster to development continuum, which reflects the real nature of the environment particularly in less developed countries.
 - Measures of effectiveness (MOE) must focus on:
- ✓ Outcome: what really happened and who was responsible.
 - ✓ Continuity of effort coordination based on information.
 - ✓ Policy: preparation, mitigation, development oriented towards disaster issues
 - ✓ Decision Points: who declares disasters to whom and when as well as who is accountable for the response
 - ✓ Impact evaluation systems that tell us what works and what doesn't that can be locked into an easily retrievable institutional memory.
 - ✓ One tool that we feel is needed, after reviewing the literature on Mitch with its various problems in making comparisons, is some form of case study methodology. The user community needs some form of standardized instrument that would allow the comparison and examination of issues related to the performance of multiple entities involved with responding to a disaster. From these critical self-analysis there is improvement.

The USG reaction to the Mitch hurricane disaster in Central

Responding to Environmental Challenges in Central Asia and the Caspian Basin

America represented a turning point in several aspects of policy and practice in dealing with international disasters.

First, the clear first response mechanism was an appropriate and aggressive proactive response on the part of the US military. This has, in part, been the emphasis for USSOUTHCOM taking a new and very proactive role in both engaging to prepare and responding to disaster circumstances. Second, the extraordinary examination of the issues and response of the US Government and international and world NGO/PVO response to the event has resulted in a much more coordinated approach to the planning for and preparing for future disaster response. This has manifested itself in many different ways including

for the first time UN (PAHO) and University (CDMHA) entities working directly with the USSOUTHCOM to address humanitarian issues of mutual importance and concern. The consequences of Mitch are still felt in the organizations that combined forces to respond to the disaster. Multiple approaches and creative solutions characterize a much more coherent approach to solving the complex problems of disaster prevention, response and mitigation. The path is clear – there is positive action based on the initial initiative of Gen Charles Wilhelm during his tenure as CINC, US SOUTHCOM.

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DISASTER RESPONSE PLANNING AND COORDINATION



By Mr. Wolfgang G. Krajic

Disaster relief has a long tradition within the North Atlantic Treaty Organisation (NATO). Although it has always been a goal of the Alliance to protect its population from the consequences of war, NATO assets were used in non-traditional roles to support relief efforts in the course of devastating floods in the Netherlands as early as 1953.



Beginning with the end of the Cold War-era, civil emergency planning and disaster relief got different dimensions for the Alliance. The creation of the Partnership for Peace (PfP) Programme and the Euro-Atlantic Partnership Council (EAPC)¹ has widened both the

scope and area of responsibility for coordination of disaster relief.

Based on a proposal of the Russian Federation, the EAPC in Ministerial Session endorsed a proposal to create a Euro-Atlantic Disaster Response Capability on 17 December 1997. This decision led to the guiding document for “Enhanced Practical Cooperation in the Field of International Disaster Relief”.

In this document, EAPC Ministers agreed in principle:

- To establish at NATO Headquarters, within the Alliance’s Civil Emergency Planning Directorate (CEPD), a small Euro-Atlantic Disaster Response Coordination Centre (EADRCC); and

¹The Euro-Atlantic Partnership Council (EAPC) to date includes the 19 NATO Allies as well as the 27 Partner nations.

- To activate, where appropriate in case of an emergency in an EAPC member country, a non-standing Euro-Atlantic Disaster Response Unit (EADRU), comprising a mix of national elements provided by EAPC members.

The Euro-Atlantic Disaster Response Coordination Centre (EADRCC)

As a first step in the realisation of this policy, the EADRCC was established and inaugurated in June 1998. The main tasks of the EADRCC are to:

- Act as a focal point for information collection and dissemination about natural and technological disasters and related fields in the EAPC area;
- Coordinate requests from a stricken country and the response of EAPC countries to such requests; and
- Develop a concept for the EADRU.

As the responsibility of requesting and providing international assistance always remains with the respective nations concerned, the EADRCC is purely a coordinating agency.

From the very beginning, it was agreed by all parties that the United Nations would retain the

main responsibility of coordination in international disaster relief. The EADRCC can be seen as a regional arrangement for the EAPC area. All tasks are carried out in close cooperation with the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA) in Geneva, as well as with other relevant international and national organisations. The EADRCC is also engaged in activities of the Stability Pact for South East Europe and a variety of other initiatives. Relations with the corresponding bodies of the (W)EU are pending a decision about the general relations between EU and NATO.

Since its creation, the EADRCC has been involved in a variety of disasters. The most challenging one, although at the same time atypical, was to support relief efforts for the victims of the Kosovo Crises in 1999.

Since 1998, the EADRCC supported the coordination of relief efforts in response to earthquakes, floods, landslides, wildfires and extreme weather conditions in Georgia, Greece, Hungary, the former Yugoslav Republic of Macedonia², Moldova, Romania, Turkey, and Ukraine as well as a number of smaller emergencies within the EAPC geographical area.

² Turkey recognises the Republic of Macedonia with its constitutional name.

As previously described, the EADRCC is an integral part of NATO's Civil Emergency Planning Directorate (CEPD) and headed by the Director, CEP. It is located at NATO Headquarters in Brussels and presently staffed by representatives of Austria, Germany, Portugal, Romania, and NATO International Staff³. A liaison person of UN-OCHA is permanently based in the EADRCC.

The Euro-Atlantic Disaster Response Unit (EADRU)

The aforementioned policy documents also provide for the creation of a Euro-Atlantic Disaster Response Unit. The concept foresees a non-standing, multi-national mix of national units volunteered by EAPC countries to be part of the EADRU. Units, which are designated to be part of the EADRU, can be of civilian or military provenience, but the EADRU as such is considered a civilian unit.

Elements of the EADRU can be deployed upon request of an EAPC nation in response to a natural or technological disaster. It will be designed according to the requirements on a case-by-case basis and can consist of Search and Rescue

(SAR) units, medical units, transport and logistics, communication, etc. As negotiations with nations and development of the concept are still ongoing, no real deployment of an EADRU has yet taken place.

However, in September 2000 the first EADRCC/EADRU exercise "Trans-Carpathia 2000" took place in the Trans-Carpathian region of Ukraine. The exercise consisted of a Command Post Exercise (CPX) to train procedures and a Field Exercise (FieldEx) in Uzghorod, Ukraine. "Trans-Carpathia 2000" was based on a flood scenario and brought together teams, units and personnel (overall some 350) from 13 EAPC nations

Disaster Response - Planning and Coordination

"Coordination is the management of interdependencies between activities" (Malone & Crowston, 1992). Activities, which are interdependent with each other, and not or only partially coordinated, normally cause frictions. This reduces efficiency and effectiveness.

To limit initial challenges three steps have been defined, which not only apply in business, but in military organisations and in disaster relief:

³ Secondees from Austria and Romania, and consultants from Germany and Portugal.

- The **sharing of information** by technical means and/or meetings raises the awareness of all involved about the activities of their respective counterparts. Ideally in disaster relief all information should be available for all involved.
- As a second step, the **sharing of tasks** reduces time and efforts of all parties and increases efficiency and commitment of all stakeholders.
- Especially in times of change (crises), **joint planning** ensures maximum efficiency and commitment.

If the parties involved are aware of the following obstacles, they can be overcome with relative ease:

- Technically incompatible communication systems;
- A lack of shared vocabulary;
- Different cultural factors and past experiences; and
- Differences in objectives and goals.

With regard to planning, the main friction point in disaster relief seems to be that most civilian organisations do not have the understanding and

expertise to conduct planning. Consequently, they are frequently forced into a purely reactive, responding role, especially during the relief phase of a disaster. Preparedness measures frequently finish at the onset of a disaster or relief operation. Rarely they contain contingency plans for different developments and a desired end-state. Undefined handover and withdrawal procedures create unfulfilled expectations and confusion and leave a gap between the relief and rehabilitation/reconstruction phases.

Disaster Preparedness and Planning

Case Study: Kazakhstan Natural Disaster Preparedness Plan

In 1999/2000, the Emergency Agency of the Republic of Kazakhstan, with the support of the United Nations Development Programme and with substantial input from the Kazakh Red Crescent and Red Cross Society, undertook the effort to compile a national Natural Disaster Preparedness Plan (NDPP).

This plan contains quite a few outstanding features with respect to planning and coordination efforts that warrant further examination. It was compiled as a joint effort of almost all government bodies involved, national and inter-

national non-governmental organisations (NGOs) active in Kazakhstan, as well as international organisations. Although titled “preparedness plan”, this compendium includes both planning/preparedness and *response* features. Finally, the whole plan was reviewed jointly by national and international experts, jointly presented to the Government of the Republic of Kazakhstan, and accepted as a part of Kazakhstan’s emergency legislation.

The NDPP includes a very clear illustration of the vertical (national, regional, and local), horizontal (regions amongst each other’s, neighbouring communities, etc.) interdependencies, and the distribution of responsibilities.

The authors of the plan included exceptional issues, which give the plan a comprehensive note. References are made to the legal background, to training as an additional preparedness measure, and to financial issues. Experience shows that international disaster relief often is delayed, because national funding issues are not resolved in advance.

One of the most important facts, however, is that the NDPP also addresses issues, which are crucial for

international disaster relief to support the national efforts, such as border crossing arrangements, customs facilitation, and relations to international organisations.

Coordination of Response to Environmental Disasters

Case Study: Spill of Mercury in Pancevo, Federal Republic of Yugoslavia (FRY)

Situation: During the NATO airstrike against the FRY in spring 1999, targets included petrochemical plants and factories. Probably on 17 or 18 April 1999, the petrochemical plant, refinery, and aircraft factory in Pancevo, FRY (approximately 25 km east of Belgrade) were targeted and hit. As a result of the damage to the petrochemical plant, up to eight





Legend

- Areas that appeared darker on the post-war image, (e.g. pollution, oil spills, missing oil tanks or buildings).
- Areas that appear brighter on the post-war image (e.g. bomb impacts).
- 1** Change in water quality in the canal collecting waste water from refinery, fertiliser and petrochemical plants.
- 2** Visible bomb impacts and destruction of buildings from the Agricultural Aircraft Factory LOLA UTVA.
- 3** Visible impacts on "unknown" buildings.
- 4** "Destroyed" Oil tanks.
- 5** Changes that may have resulted from oil spills.
- 6** "Destroyed" buildings in both fertiliser and petrochemical plants.

within the compounds of this plant.

Why does this example demonstrate a variety of issues concerning coordination in disaster relief? One might argue that there have been more serious environmental disasters in the area of the FR Yugoslavia and elsewhere. The United Nations Environment Programme, which is one of the leading agencies to deal with environmental issues in the Balkans, does not even classify them as disasters (they use the term "hot-spots"), because of their nature. However, the most important milestones in the clean-up efforts of this particular "hot-spot" show

tons of mercury were spilled

clearly, where the restraints for coordination are located.

I also chose this case study, because all of us are familiar with countermeasures after a private mercury-spill. If you break an old-fashioned thermometer, which contains mercury, you will be probably very quick in opening the windows of the room and in removing the drops of the liquid mercury on the floor, because of its toxic and volatile nature. Let me provide you with a short summary of the most important benchmarks for this particular emergency.

As mentioned before, the spill occurred most likely on 17 or 18 April 1999.

- The first local assessment by the management of the petrochemical plant took place a few days later, but no countermeasures were taken.
- The first international assessments were conducted in late July and early August 1999, three and a half months later.
- I was in Pancevo in late September 1999 and the situation was still unchanged.
- Finally, in mid-October specialized teams of FOCUS Humanitarian Relief

Operation started the clean-up of the mercury spill and finalized this project in early December 1999 (eight and a half months after the spill occurred).⁴

Why did it take that long to start to solve this relatively simple problem?

The main reasons were constraints to coordination:

- Environmental emergencies and disasters have a tendency to be more politically sensitive than natural disasters, because frequently they are man-made disasters. This phenomenon is aggravated, if they occur as a consequence of hostilities;
- Environmental emergencies require normally a more regionally oriented approach, because they rarely are confined to the territory of one single nation. Therefore the step from national to regional or international coordination has to be done;
- National, regional, or local “pride” tends to rather cover the consequences of

⁴ FOCUS Humanitarian Relief Operation is an ad hoc initiative of the governments of Austria, Greece, the Russian Federation, and Switzerland to render assistance to the whole FRY (i.e., Serbia including the provinces of Kosovo and

- environmental disaster then to alert neighbours and the international community, even if the consequences cannot be tackled with locally available resources;
- Environmental emergencies (with a few exceptions) do not attract mass media to the extent natural disasters and complex emergencies do (CNN-effect). They are often controversial issues, which are extremely difficult to discuss and coordinate.
- Almost no type of disaster or emergency is confined to the territory of one nation and therefore requires a regional approach.
- As a consequence of the above, a joint (vertical and horizontal) effort also with respect to geographical regions is desirable.
- Even environmental disasters (or preparedness measures) should be made “non-controversial” issues, in order to facilitate a coordinated approach to planning, response, and coordination.

Conclusions

Besides all of the general coordination measures and the referring constraints mentioned above the following conclusions can be drawn:

- Planning and disaster response measures should always contain an environmental facet, because normally natural and technological disasters as well as complex emergencies include environmental damage, even if it appears as a secondary effect with lower priority.

MILITARY SUPPORT TO CIVILIAN AUTHORITIES



By Colonel Bruce Bodin

Over the past two days we have discussed some of nature's toughest disaster response challenges in the form of earthquakes, floods, and hurricanes. We have also seen how man-made disasters such as oil spills; poor land management and inadequate industrial waste disposal planning can place entire regions under an environmental "Sword of Damocles"¹.

This condition of environmental insecurity is a constant not only in Central Asia and the Caspian Basin, but also throughout the world. The only remedy is the existence of effective disaster response planning and coordination mechanisms at all levels of government. Usually these organizations, like The Euro-Atlantic Disaster Response Coordination Center, are civilian agencies without major in-house response capability. To achieve a timely response to a disaster they request outside assistance from international and regional organizations and from the military. My objective today is to discuss the processes in place today in the United States, in general, and in the State of Arizona, in particular that

¹ Damocles was an attendant in the royal court of the Greek tyrant Dionysius the Elder of Syracuse. Damocles talked so incessantly about the happiness of Dionysius that the tyrant decided to teach Damocles a lesson. Dionysius held a grand banquet, and invited Damocles to sit at the place of honor. Just as Damocles was beginning to enjoy himself, he was horrified to discover a sword hanging over his head, suspended by a single hair. In so doing, Damocles learned from Dionysius the perilous nature of his life.

produce responsive military support to civilian authorities (MSCA).

In all cases, and at all levels of government, the immediate goals of the military in responding to a disaster are to save lives, prevent human suffering, and to mitigate great property loss. At the national level, the Federal Response Plan (FRP) describes the basic concept of operations by which the Federal Government will respond to a significant natural or man-made disaster or emergency. The Federal Emergency Management Agency (FEMA) directs and coordinates Federal emergency and catastrophic disaster relief on behalf of the President. FEMA has designated twelve Emergency Support Functions (ESF) that include transportation, communications, public works and engineering, fire fighting, information and planning, mass care, resource support, health and medical services, urban search and rescue, hazardous materials, food, and energy.

The US Department of Defense (DOD) is the primary federal agency for Public Works and Engineering, and a supporting agency for all other emergency support functions. At the national level the Director of Military Support (DOMS) is the "action agent" for planning and conduct of peacetime assistance rendered to civil authorities and

provides the tasking channel for all DoD assistance.

In all situations the national or local government officials remain in charge of the situation. The military supports civil authorities and maintains an internal chain of command.

This national process is mirrored at the State level. The Adjutant General for the State of Arizona is responsible to the Governor for the training, sustainment and deployment of a military force capable of supporting national, state and community interests for the protection of life, property, preservation of peace, maintenance of order and public safety.

NATIONAL GUARD MISSION

To assists in planning, coordinating, resourcing, and executing all CONUS emergency response missions, deployments, and exercises.

Military Support to Civil Authorities (MSCA) is the employment of military resources (personnel & equipment) in support of civil authorities during periods of emergency (DoDD 3025.1). In most cases this includes Army and Air National Guard Units. Civil authorities have primary responsibilities for emergency planning, response, and recovery during emergency situations. Emergencies that

could result in military support are:

- Civil: Any man-caused emergency or threat, which causes or may cause substantial property damage or loss.
- Natural: Any hurricane, tornado, storm, flood, high water, wind driven water, tidal wave, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, or other catastrophic event.
- Other: An emergency in any part of the United States which requires assistance to supplement local or state efforts to save lives and protect property, public health and safety, or to avert or lessen the threat of a disaster.

MSCA missions are authorized by Executive Order of the Governor of a state, using his/her state's National Guard. MSCA missions are of a temporary nature and will be terminated as soon as possible after civil authorities are capable of handling the emergency. Employment of National Guard assets by the Governor will be in accordance with state laws and constitutions.

The Federal Response Plan (FRP) describes the basic

concept of operations by which the Federal Government will respond to a significant natural or man-made disaster or emergency under the authorities of the Stafford Disaster Relief and Emergency Assistance Act (PL 93-288, as amended). This plan is designed to facilitate federal response assistance, which supplements the efforts of state and local governments in dealing with a catastrophic disaster and emergency situations. The Federal Emergency Management Agency (FEMA) directs and coordinates Federal emergency and catastrophic disaster relief on behalf of the President under the provisions of specific Public Law. FEMA has designated twelve Emergency Support Functions (ESF) which include transportation, communications, public works and engineering, fire fighting, information and planning, mass care, resource support, health and medical services, urban search and rescue, hazardous materials, food, and energy. The 12 ESF's serve as the primary mechanisms through which federal assistance will be provided to assist a state. There is a federal agency designated to be the lead for each ESF, DOD's is the primary federal agency for ESF #3, Public Works and Engineering, and a supporting agency for all other ESF's.

The Director of Military Support (DOMS) is the “action agent” for planning and conduct of peacetime assistance rendered to civil authorities and provides the tasking channel for all DoD assistance. The CINC’s designates a Defense Coordinating Officer (DCO) to liaison with the DOMS for tasking.

NOTE: The First and Fifth Army Commanders actually appoint the DCO to coordinate with the civilian leaders from the Federal Government, usually the Federal Coordinating Officer (FCO) to the appropriate CINC (1st, 5th Army, FORSCOM, or JFCOM), only used in CONUS.

immediate human suffering, or lessen major property damage or destruction. They do not need permission to perform immediate response from higher HQ but must notify the higher HQ that they are providing assistance as soon as possible.

Call-Out by Civil Authorities. National Guard assistance normally is provided when:

- The situation is so severe and so widespread that effective response and support is beyond the capacity of local and state government and civil resources have been exhausted.

CAPABILITIES

- *Personnel* Well-disciplined Army and Air Guard personnel, with military and civilian acquired skills.
- *Equipment* HMMWV’s, large 5-ton trucks and trailers, engineer equipment, aircraft (Helicopters), and support equipment generators, tents, light sets, and signal equipment.

CONSIDERATIONS FOR EMPLOYMENT

Emergency Response Doctrine. When an emergency or disaster occurs National Guard personnel may respond immediately, when requested to do so, to save lives, prevent

- Required resources are not available from commercial sources. National Guard support will not be furnished if it is in competition with private enterprise or the civilian labor force.
- Resources normally committed as a supplement to civil resources to cope with humanitarian and property protection requirements.
- Limited to tasks that, because of experience and the availability of organic resources, the National Guard can do more effectively or efficiently than another agency.

- When public service is lost or withdrawn and an immediate substantial threat to public health, safety, or welfare is evident.

Types of Missions. Wildfires, earthquakes, floods, storms, civil disturbances, search and rescue, terrorism, humanitarian aid, tornadoes, and hurricanes.

REQUEST FOR ASSISTANCE, HOW MISSIONED

When local, city, or county resources become overwhelmed, a request for support is forwarded to the Arizona Division of Emergency Management (ADEM). ADEM reviews request to determine if the Governor should declare a State of Emergency. The Governor approves/disapproves the Emergency Proclamation and authorizes the Adjutant General to mobilize the National Guard to State Active Duty. If state resources are overwhelmed, the Governor will request a presidential declaration, and upon approval of the Presidential Disaster Declaration, the FRP will be implemented. All requests for National Guard support is submitted through ADEM, to the NG liaison officer, to the state NG operations center, and missioned/tasked to the mobilized Task Force. NG forces are typically last in and first out of a SAD mission.

COMMAND AND CONTROL

The National Guard assistance is provided in support of civil authorities, and do not to replace civil authority command jurisdiction. National Guard forces remain under the command and control of NG Officers, and missioned through the National Guard Chain-of-Command in coordination with civil authorities. The Governor is the commander in chief of all Army and Air National Guard units within his/her jurisdiction, which are not in active federal service. Command of the National Guard is normally exercised through the Adjutant General or designated military representative. National Guard Bureau (NGB) is the federal military coordination, administrative, policy, and logistical center for the Army and Air National Guard. DANGB has been designated as the Action Agent for MSCA operations. The National Guard may be ordered in militia status to aid civil authorities under Executive Order No. 11485, 3 OCT 19.

STATUS OF PERSONNEL

During periods of State Active Duty (SAD), soldiers who are activated are placed on state active duty orders and covered under state employment rules for injuries and disability issues.

REIMBURSEMENT

When federal property is used by National Guard personnel in a SAD status, the state will be liable for reimbursement or replenishment in kind to the federal government through the USPFO. The following are reimbursable: Repair parts, other than fair wear and tear, expended during the incident; POL expended for direct mission accomplishment; incremental costs, costs above the expenses which normally accrued during scheduled training periods, which can be attributed to direct mission support. Uses of aircraft reimbursement policies are outlined in NGB Pam 9-5 and AR 700-131. MSCA funds are budgeted each year by the Governor. The federal government (FEMA) reimburses any MSCA operations that become federal disasters with a cost sharing agreement (25% state/75% federal).

CLOSING

The National Guard is a vital asset to the Nation and States by providing Military Support to Civil Authorities by providing an organized, trained, and timely force to respond and support local agencies with natural and man-made emergencies in accordance with Federal and State laws

MILITARY MEDICAL SUPPORT TO ENVIRONMENTAL SECURITY AND DISASTER RESPONSE



By Commander Michael J. Sircy

Military medical units have unique capabilities for supporting Environmental Security and Disaster Response within a country or in a regional response. If used properly, they can supplement existing health resources to provide comprehensive support.

Specific examples of the types of support that can be provided are:

- Disease surveillance
- Training for triage of patients
- Re-establishment of basic health care services
- Supplement to existing facilities
- Management of chemical, biological and radiological patients from an incident
- Training for care and management with trauma and burn injuries

Environmental Security, and Disease Surveillance:

Military medical units often have preventive medicine or public health personnel organic to their capabilities. These personnel have specific training in disease diagnosis, data collection, and disease cause investigations/treatment.

In the areas where there are known environmental issues (i.e., uranium tailings in this region), these personnel can establish surveillance programs to gather data on disease occurrences and trends associated with the hazard. From these evaluations, recommendations can be made to the local government and/or military advisor on the proper health precautions, hazard containment, and treatment procedures in the event of acute and chronic exposure. If the program is aggressive, many disease occurrences may be avoided, thus increasing the overall health of the population at risk.

Another outgrowth of this type of program is the establishment of specific treatment protocols. In many areas local civilian physicians may not have had the exposure to specific diseases that are known to military physicians. While the military units work to assist in environ-

mental and preventive medicine surveillance, a vast wealth of knowledge may be passed to increase the treatment capabilities in any area at risk.

A side note however, is that none of the items discussed above are achievable unless all health care providers, both military and civilian, aggressively monitor and report environmentally associated disease. This is necessary, as the first indication of exposure may be an increased number of patients with similar symptoms coming to a health care provider for treatment.

Natural Disasters

A natural disaster can severely overwhelm or completely destroy the basic health care and health care support capability of a city or region. If this occurs, use of the military medical units can assist with or provide interim basic health care capabilities to the affected area.

This is done through the deployment of field medical units and personnel. This has been done by the United States, both within the United States and in other areas. Examples are:

- South Florida: Following Hurricane Andrew, when the civilian infrastructure was severely damaged.
- Somalia: In conjunction with the United Nations following

a severe food shortage when rival clan wars crippled or destroyed local facilities.

- Turkey: Deployment of preventive medicine personnel to investigate possible disease outbreaks following an earthquake.

Military units are particularly suited for these types of missions as they are self sustaining, have needed medical materials and supplies, and the associated health care professionals to manage medical needs. A secondary benefit to the deployment of a field facility is the calming factor on the local population. This meets one of their basic needs and thus relieves some fears of uncertainty for them.

The military medical facility also brings unique capabilities to the affected area. Almost all of the military providers are trained in patient sorting or “triage” procedures. This is where patients are sorted into priority categories for treatment, so that the most good can be provided to the greatest number in the shortest period of time. Training may be provided to civilian providers ahead of time and if the incident occurs near a military facility, military personnel can assist in this procedure.

Additionally, in areas where chemical, biological and radiological concerns exist, the

deployed military facility normally have personnel assigned who can set up treatment and monitoring protocols for the exposed population, assist in decontamination procedures, identify potentially contaminated areas and assist in isolation procedures. These personnel have had basic or unique military training that are often civilian health care providers do not have.

The deployed medical facility also brings needed medical and surgical capabilities if the local health care infrastructure is overwhelmed. It provides a supplement that may be necessary.

If the infrastructure is completely destroyed, a basic health care system and referral center can be provided until the government and local facilities can recover and conduct necessary repairs. This meets needed health care to the population and ensures that possible disease outbreaks are dealt with in a timely fashion through on scene providers. This is especially true if temporary "displaced personnel camps" become required for the temporary housing of affected personnel. In camps, over crowding often occurs and the ideal medium for rapid disease spread exists. The deployed medical facility can respond and prevent major disease outbreaks. The medical units possess a re-supply capability that can

ensure needed medical supplies arrive. Also, the unit supply personnel can assist in the overwhelming task of sorting through donations that may arrive.

A final form of assistance that can be provided is in the area of trauma and burn injuries. Natural and/or man-made disasters can present a wide range of injuries. Some of these can result in extremity injuries, amputations, impaled objects, etc. Military medical health care providers are trained in these areas and can easily provide assistance.

Summary

Military medical units and deployable facilities do not have "just a war-time" mission. If used properly they can assist in the areas of environmental security through disease surveillance monitoring and establishment of preventive measures. They also may provide a service in response to disasters to assist in re-establishment or supplement of health care delivery to an affected population.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

CHAPTER 6 – *Crisis Management Exercise*

Exercise Director: Professor Bernard F. Griffard

Scenario One: Ferghana Valley Earthquake

Scenario Two: Caspian Sea Oil Spill



Responding to Environmental Challenges in Central Asia and the Caspian Basin

CRISIS MANAGEMENT EXERCISE *A Disaster Response Simulation*



By Professor Bernard F. Griffard, Exercise Director

Conference planners faced the challenge that the number of issues dividing the Central Asia Republics was greater than those uniting them. It was necessary to identify a vehicle from which key issues could be addressed without being confrontational. Using the environmental security issue of disaster response planning as the primary topic, the conference clarified the environmental issues central to the security of the region and emphasized the importance of both military environmental stewardship and cooperative contingency planning in responding to these threats. This approach complemented the efforts of USCENTCOM to clarify how environmental issues could promote regional stability and cooperation, and enhance peaceful engagement.

OVERVIEW

In the first four conference sessions participants discussed environmental security issues, disaster response planning and coordination, and military support to civilian authorities with resource persons from Latvia, the Philippines, Turkey, the United States, the World Bank Group, and NATO/ Euro-Atlantic Disaster Response Coordination Center (EADRCC). These discussions set the stage for the Crisis Management Exercise (CMX), a simulation that addressed the planning and execution of national and regional responses to environmental crises in the

Central Asia region. During the CMX participants acted as their nation's representative to the ad hoc regional organization brought together to address the impact of a major man-made or natural disaster. For this simulation the participants and resource personnel were divided into three regional crisis management teams where they applied their personal knowledge, professional training and understanding of the region to evaluate significant infrastructure and environmental damage. Two teams examined the effects of a major

earthquake in Central Asia's Ferghana Valley, and one team responded to a maritime accident and oil spill in the Caspian Sea. Acting as primary national and regional officials, they identified civilian emergency planning processes and the military support to civil authorities required to respond to the crises. Consisting of two moves, the CMX scenarios provided the role-players with information on the disaster and then asked them to identify the key agencies and processes that required activation at this stage of disaster response. At the conclusion of the CMX each crisis management team presented their findings to the conference plenary. These presentations provided the conference participants with the following insights: 1) a nation's military priorities should include the protection of it's people from man-made or natural disaster induced environmental threats;

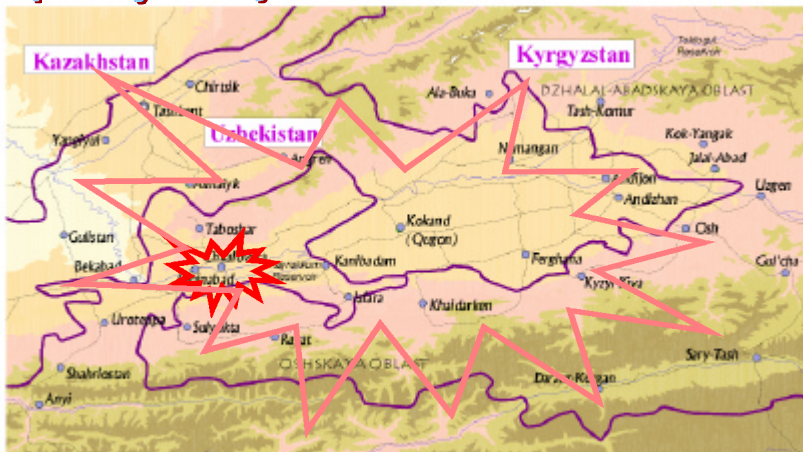
2) although most countries have some semblance of a disaster response infrastructure, multilateral regional cooperation is much more likely in a Caspian Sea environmental event than for a disaster in the land locked nations; 3) economically disadvantaged nations such as Tajikistan are least equipped to deal with an environmental crisis; and, 4) sustainable development is more difficult to achieve in Central Asia than in the developed world.

FERGHANA VALLEY EARTHQUAKE SCENARIO

Initial Situation

Today is March 7, 200X. An earthquake of 7.5 magnitudes on the Richter scale has hit Central Asia in the foothills of the Zeravshanskiy Mountains.

Earthquake: Ferghana Valley - March 200X



The epicenter is located SE of Chkalov, Tajikistan, and less than 40 km from Khujand (formerly Leninabad). The earthquake has been felt as far away as Osh, Kyrgyzstan and Tashkent, Uzbekistan. Aftershocks have been registered at seismologic monitoring stations in Namangan, Andijon, and Farghona Uzbekistan.

The earthquake has damaged the railroad and highway corridor that skirts the southern shore of the Kayrakkum Reservoir, severing ground transportation between the Ferghana Valley and Uzbekistan to the west. In addition to physical damage to this infrastructure, the earthquake has dislodged rock and debris that has fallen onto portions of the highway and railroad. Numerous utility poles carrying telephone cables along this corridor have fallen, impacting communications between Khujand, Tajikistan and Kokand, Uzbekistan.

Additionally, the main natural gas distribution pipeline from Uzbekistan to the Ferghana Valley has been shut down as a result of a pressure loss somewhere to the east of Chkalovsk. The Kayrakkumskaya dam on the Syr Darya River is located within 30 km of the epicenter, and the integrity of the dam is unknown at this time. This potential catastrophe places at risk the populations of Khujand and its neighboring cities in Tajikistan

and Uzbekistan to the west along the Syr Darya.

The disruption of ground transportation has been immediately felt in the Ferghana Valley. With a total population of 2.2 million, the portion of the valley to the east of the Kayrakkumskaya reservoir is isolated from normal commerce. Neither people nor goods can move between the western portion of Uzbekistan and the valley. Mountain roads leading out of the eastern end of the valley, connecting northern and southern Kyrgyzstan remain seasonally impassable to truck traffic.

This has been the first major earthquake in memory to strike the towns lying below the Kayrakkum Reservoir. Damage to homes as well as to older multi-story buildings built before the 1966 Tashkent earthquake has been extensive. In Chkalov and Khujand the city utilities infrastructure is disrupted. Without running water or adequate sewerage disposal the population of this area is highly vulnerable to the spread of diseases such as cholera and typhoid.

Early reports have been limited to this general evaluation of civic infrastructure. Damage to industrial sites, factories,

mining complexes, and waste lagoons in the region have not yet been evaluated.

Situation Update

It is now March 8, 200X, twenty-four hours following the first reports of the earthquake. The weather in the earthquake-affected region is cloudy and cool, with a forecasted high of 7°C (45°F) and a low of -3°C (27°F). Rain showers are expected within the next 48 hours.

Known human losses from the earthquake are concentrated in the urban areas of Leninabad Oblast (Khujand). Current estimates are 300 to 500 persons dead and more than 2000 injured in this area alone. Fire officials report numerous persons trapped in the debris of collapsed apartment houses. Over 10,000 residents of the region are homeless. Police report that the road from Khujand, Tajikistan west to Bekabad, Uzbekistan is full of travelers moving west by vehicle and on foot. Officials in Kokand, Uzbekistan report eight fatalities and 37 injuries, mainly from falling debris. Human losses in southwest Krygyzstan and the portions of Tajikistan north and east of the Kayrakkum Reservoir remain unknown at this time.

Despite widespread power outages in the lower Ferghana Valley, the Kayrakkum hydroelectric power generating station remains

operational. Railway officials estimate that it will require three to four weeks of demolition, earthmoving and reconstruction to restore rail service between Chkalov, Tajikistan, and Kokand, Uzbekistan. The highway adjacent to this damaged rail line will be closed for at least one week, and then will open for limited service only until railway repairs are complete. The loss of telephone lines and the ground transportation link between Khujand, Tajikistan and Kokand, Uzbekistan continues to make damage assessment difficult. Rock and mudslides have closed many mountain roads, and Tajikistani and Kyrgyzstani officials have dispatched foot patrols to conduct damage assessments into several isolated mountain enclaves.

There are strong indications that poisonous tailings disturbed by earthquake-induced flooding are finding their way into the waterways and may be leaching into the groundwater supply. The tailings include residue from former and current uranium oxide, molybdenum, gold, antimony, mercury, tin, and Tungsten mining operations. There is also concern that the flooding and landslides may rupture the containment of radioactive waste dumps near Jalal-Abad, and the former

SCENARIO ONE
Ferghana Valley Earthquake

| <u>Move One</u> <u>Assessment & Coordination</u> | <u>Move Two</u> <u>Response & Recovery</u> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none">1. Identify the agencies that are responsible for assessing the extent of earthquake damage and identifying immediate relief requirements?<ul style="list-style-type: none">➤ For the Region?➤ For Kyrgyzstan?➤ For Tajikistan?➤ For Uzbekistan?2. What are their planning and coordination responsibilities? | <ol style="list-style-type: none">3. What procedures are in place for coordinating military support to civilian agencies and the integration of military and civilian capabilities?<ul style="list-style-type: none">➤ For the Region?➤ For Kyrgyzstan?➤ For Tajikistan?➤ For Uzbekistan?4. What are the existing agreements or procedures for regional disaster response cooperation? |

uranium refining plant and waste dumps at Maili Suu. Both cities are in the Kyrgyzstan portion of the Ferghana Valley, in the Syr Darya watershed, just across the Uzbek border.

The sewer and water distribution systems in the urban areas of Khujand and Chkalov have been compromised. Water samples from the Syr Darya 3 km downstream of Khujand show increased turbidity and a fecal coliform bacteria level of 2600 per 100 ml.

CRISIS MANAGEMENT TEAM FINDINGS

Group 1 - Col Rinat Zalyaletdinov, Uzbekistan

In our initial discussions we explored the peculiarities of

earthquakes in the Ferghana Valley region. As always a primary concern is for the water reserve. First, we must explore whether or not the earthquake damage has raised the risk of flooding. The failure of major dams in the region has the potential for a trans-national flood disaster. We are also concerned with maintenance of water quality. Pollution of water is possible from chemical plant retention pool overflows, mudslides, or the injection into the water system of uranium tailings from breached storage areas caused by the initial earthquake or its aftershocks.

Next our Crisis Management Team looked at assessing the results of this earthquake. The timing of the earthquake

was a concern. March is a tough season because it gets cold at night and is rainy in the day. This makes establishing temporary shelters in the hardest hit areas a priority. This would be difficult because the destruction of the rail and road network in the valley cuts off the delivery of food and other vital commodities to the region. This raised the issue of a food crisis for 2.2 million people in Uzbekistan. Since damage across the region was not uniform it was necessary to assess the scale of destruction by country, and then by Oblast. It quickly became obvious that this was a regional scale emergency because of the threat to Kyrgyzstan of water contamination caused by the intrusion of uranium tailings due to earthquake induced flooding. Another trans-national issue that had to be addressed was the looming power crisis due to damage to the gas pipeline.

Currently, the Central Asia Republics operate under the principle of "territorial industrial". This means that each local site and each republic must deal with the problem at the local level and then go up to the next level if there are inadequacies. A major disaster such as this Ferghana Valley earthquake emphasizes the need to set up an inter-governmental commission that has representatives from all involved ministries. Each key government agency and critical NGOs and International Organizations (IOs) must be

represented. For example, the government Ministries of Internal Affairs, Communications, Firefighting, Material Support (i.e. transport), and, in Uzbekistan, the Uzbek Red Cross - the only NGO tied into the MES.

During the first day's initial assessment the priority is first aid and SAR for the people; property is a secondary concern. We must find out the number of people located near the epicenter as soon as possible, and make arrangements to provide potable water to the populations in these and other damaged areas. Currently, there is an inter-governmental agreement among the Central Asia republics to send three emergency medical assistance brigades to the disaster area. Implementation of this capability must be coordinated and prioritized. Additionally, pipeline damage must be assessed due to its immediate impact on power availability and the further possibility of environmental damage due to leaks. All this is centrally coordinated so communications facilities must be established as soon as possible.

As we moved into Day Two of the crisis our team was told that there were 10,000 people

without shelter; a threat of disease caused by water contaminated by heavy metals and bacteria; and, in Kyrgyzstan, the threat of waste contamination due to rains. From experience, we know that it is very hard to have all the desired information within the first two days, so assumptions had to be made as to priorities and solutions. With regard to providing temporary shelter, tent camps were not an option since Tajikistan doesn't have that capability. Our first choice to provide the necessary shelter was to use six or seven of the local schools. If enough schools were not available then local officials would have to make shelters out of whatever buildings could be used. Finding shelter for 10,000 people out of a 600k population is manageable. Three hundred people are reported needing immediate medical assistance; if hospitals aren't damaged they can handle it, if they are damaged then there is a requirement for special medical teams from neighboring countries to helicopter into the area. Was it possible to solve the contamination problem in Kyrgyzstan with engineers diverting water? This question would resolve itself over time.

The final issue we addressed was how best to employ available military capabilities to assist in disaster response. In the coordination center the military is tied into the MES through the MoD representative. One military asset

that would be in great demand would be their transport capability. It was estimated that the population of the Ferghana Valley had food reserves for the first two days following the earthquake. Since the railroad won't be repaired for a month, the military would be tasked to transport food into the Valley until a civilian ground link could be reestablished. Other missions that make use of specific military capabilities were using the armed forces to provide security at critical locations and to gather and provide threat intelligence to the MES. A disruption in public services such as that caused by the Ferghana Valley earthquake provides a possible window of opportunity for terrorist activity. This is why the Ministry of Internal Affairs (MVD) and the MoD are part of the coordination center. These agencies control the special purpose forces that are employed to thwart terrorism.

Group 2 - Mr. X Sarnogoev, Kyrgyzstan

In our discussions we were able to look back to 1991 when a similar earthquake, 7.5 Richter scale, occurred in Kyrgyzstan. Then, as in this scenario, roads and railroads all over the Ferghana Valley are impassable and damaged and the main gas pipeline was shut down. In such a major

crisis the question is who should respond in the first stage? Different countries have different structures. Today, in Kyrgyzstan, the Ministry of Emergency Situations (MES) would manage the response effort.

During our discussions we were quick to find common ground. Uzbekistan has a Ministry of Emergency Situations (MES) as does each other country. The MES is in charge of doing the damage assessment and there is an inter-governmental agreement for a coordination committee for information and assistance. This regional inter-governmental council executes the orders of the heads of state and interfaces with the international community. The actions of the inter-governmental council do not restrict the option of each member country to act individually.

Our crisis management team (CMT) agreed that the following actions must be taken as soon as possible:

- Inspect the dam and water reserves in Kyrgyzstan because if the dam breaks they threaten other countries too.
- It is essential to prevent the water supply from becoming contaminated. Near Mali-Syr, Kyrgyzstan, there are about 25 nuclear waste sites. These must be guarded. Kyrgyzstan has a plan to accomplish this and it has been exercised.

Kyrgyzstan has a civil defense law that stipulates who is in charge of what. The MES has troops and the MoD can be involved as well. In Kyrgyzstan the MES is already integrated into the MoD and each Oblast has an MES commission. As a planning measure, seismologists have developed a map showing the possible fault lines and meet once a year to compare what actually happened with their forecast. Another issue is the provision of information to the people in the disaster area. In Kyrgyzstan this is the responsibility of the MES and the Oblast committees. To accomplish this mission these agencies have established links with the mass media and the non-governmental organizations (NGOs) as well.

CASPIAN SEA OIL SPILL SCENARIO

Initial Situation

2107 hours 6 March 200x.
Officials at the port of Turkmenbashi, Turkmenistan have received an emergency radio broadcast from the captain of the Tug *Petropul*. The Kazakhstani registered Tug was en route from Aktau, Kazakhstan to the port of Neka, Iran, towing a barge tank. The barge is filled to capacity with 100,000 barrels (4.2 million gallons) of crude oil. The Tug's towline parted

in heavy seas and has wrapped itself around its propeller, rendering the Tug non-operational. The crew has been attempting to unfoul its propeller since 2015 hours. At approximately 2105 hours the crew heard a loud noise as the drifting barge was apparently struck by another ship. The barge and Tug are adrift northwest of Cheleken, Turkmenistan. It is well past sunset, and deteriorating weather has limited visibility over this part of the Caspian Sea.

2110 hours 6 March 200x The master of the Azerbaijan cargo-passenger ferry *Yuri Baku* reports that his vessel struck something

solid in the dark. The *Yuri Baku* is on a routine trip from Baku, Azerbaijan to Turkmenbashi and is located due west of the channel entrance to the Krasnovodskiy Zaliv. Water depth at the collision site is 25 meters.

2115 hours 6 March 200x The master of the *Yuri Baku* reports his ship is down in the bow and is taking on water rapidly. He says that the struck vessel appears to be an oil tank barge, and that it appears to be leaking. He requests urgent assistance in rescuing his 250 passengers and in saving his ship.

SCENARIO TWO **Caspian Sea Oil Spill**

Move One

Assessment & Coordination

1. What are the immediate, near term, & long-term concerns:
 - For the Region?
 - For Kazakhstan?
 - For Turkmenistan?
 - For Other Caspian Basin Countries?
2. What agencies are responsible for these assessments?

Move Two

Response & Recovery

3. How do civil ian agencies within the affected countries obtain & coordinate military support to civil ian agencies?
4. What are the existing agreements or procedures for regional disaster response cooperation?
 - Civil ian support
 - Military support

Situation Update

0200 hours 7 March 200X The captain of the oil service craft *Dragon Star IV* has radioed the following summarized report to Turkmenbashi: "The ferry *Yuri Baku* sank before midnight in 28 m of water near the collision site. There are numerous survivors, some in lifeboats and others in the water. I have the First Mate of the *Yuri Baku* on board my boat now. Two oil service craft and one helicopter from the Dragon/Odyssey field are in the area attempting to pull survivors from the water. The water remains rough with 20-knot winds from the west. The Tug *Petropul* remains immobilized. Its oil barge tank has drifted to the east toward the harbor (Krasnovodskiy Zaliv) but I cannot see it in the dark. Of the 14 ferry survivors that this craft has pulled directly from the water, all are covered in black oil."

0650 hours 7 March 200X A helicopter pilot from the Dragon/Odyssey field has transmitted this report to Turkmenbashi:

"Now that it is daylight I can see that we've got a major spill out here. The barge is practically submerged now, but I see a huge gash in it. The *Yuri Baku* has practically split that tank in two. I would say that the spill is covering an elongated 4 km² ea and is about 3 km west of the channel entrance. With this stiff breeze from the west the spill is headed toward land rapidly."

CRISIS MANAGEMENT TEAM FINDINGS

Group 3 - - Gen-Major Uraz K. Rakyshev (Kazakhstan)

In this scenario, because of the location of the incident, information exchange and search and rescue (SAR) efforts would primarily fall to Turkmenistan. When such a maritime event occurs all ships in the Caspian Sea must approach to aid in passenger rescue. Coordination of the efforts of all assisting countries is essential. In Uzbekistan and Turkmenistan there are several ministries that can react. Currently there is no regional center to accomplish this mission. One is needed.

With regards to the problem at hand, search and rescue operations and localization of the oil spill, I raise the following points:

1. Due to low water temperatures in the Caspian Sea, helping people is the primary task.
2. Next there is the requirement to conduct an assessment of the oil spill. Commissions exist in both Turkmenistan and Kazakhstan for this purpose and they need to exchange information.

3. Turkmenistan has emergency units in two nearby ports including a hospital ship. However, they probably don't have enough means to evacuate the passengers. Border Troops (this is a separate ministry or agency usually in post-Soviet states) can help.

4. A long-term perspective of the problem needs to be assessed by an inter-governmental commission headed by Turkmenistan. This commission needs to exchange information with Russia, Iran, and Azerbaijan. The Russian Ministry of Emergency Situations can help too.

5. Turkmenistan needs to start to eliminate the oil spill. They must do a reconnaissance on the following day to assess the situation and inform the other Caspian region states of their findings.

6. Since the oil spill covers only four square kilometers, the four countries in the region can manage the situation themselves. International assistance is not required.

Now as to the question of how do civilian agencies receive help from the Ministry of Defense (MoD). In Kazakhstan and Turkmenistan, special commissions already exist where all government ministries are represented. Through these commissions civilian authorities

must identify specific requirements that are then passed to the Armed Forces.

CONCLUSION

As the Central Asia Republics continue to address the environmental legacy bequeathed to them by the rulers of the former Soviet Union the criticality of effective disaster response procedures is readily apparent. In the region a serious man-made or natural environmental disaster will quickly overwhelm the response resources of the individual republics and become a trans-national issue. Therefore, it is critical that opportunities be provided for the key disaster planners from each of the Republics to work together as often as possible. This CMX provided an excellent venue for such cooperation and resulted in a free exchange of ideas between the participants. While reviewing the national responses required by the scenarios, they discussed the parallel actions necessary throughout the region to limit the long-term environmental security impacts on their populations. This initial effort has laid a solid foundation for future USCENTCOM engagement activities in Central Asia and the Caspian Basin.

Responding to Environmental Challenges in Central Asia and the Caspian Basin

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Responding to Environmental Challenges in Central Asia and the Caspian Basin

APPENDIX B - Conference Agenda

Day 0 (5 March 2001)

19:30 **Icebreaker Social**

Day 1 (6 March 2001)

08:45 **Call to Order:** *Administrative Information*

08:50 **Marshall Center Welcome:** *COL Franz-Xaver
Lauterer, Director, Conference Center, George C.
Marshall European Center for Security Studies*

09:00 **Conference Purpose & Scope:** *Lieutenant General
Michael P. Delong, Deputy, Commander-in-Chief,
US Central Command*

09:10 **Responding to Environmental Challenges:** *Mr.
Curtis Bowling, Office of the Deputy Undersecretary
of Defense, Environmental Security*

09:20 **Environmental Intelligence Briefing** (*MR Clifford
Fowler, Chief, Strategic Issues, Directorate of
Intelligence, CC J2, USCENTCOM*)

09:40 **BREAK**

10:00 **Session I: Global Focus: Defining the Issues
Panel (Moderator: Dr. Kent Butts, Center for
Strategic Leadership, USAWC)**

- *Defining Environmental Security* (Dr. Kent Butts)
- *Learning from the Valdez Oil Spill* (VADM Clyde Robbins, USCG (Ret.), Federal On-Scene Coordinator, Valdez Oil Spill)
- *Mozambique Floods* (Professor B.F. Griffard, USAWC for LJ Buys, Chief Director: Disaster Management, Department of Provincial and Local Government, RSA)

Responding to Environmental Challenges in Central Asia and the Caspian Basin

12:00 **Group Photo**

12:15 **LUNCH**

13:30 **Session II: *Regional Focus: National Experiences Panel (Moderator: Dr. Bryan Shaw, United States Government)***

- *Caspian Basin Analysis* (Dr. Brian Shaw)
- *The World Bank Experience* (Mr. David Pearce, World Bank)
- *National Experiences* (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan)

16:00 *Participant Interface Activities/DENIX Demonstration*

18:00 **DINNER**

Day 2 (7 March 2001)

08:30 **Azimuth Setting**

08:35 **Session III: *National Focus: Military's Role In Environmental Security (Moderator: Mr. Curtis Bowling, (Office of the Deputy Undersecretary of Defense, Environmental Security)***

- *Military Roles in Environmental Security: Military Stewardship – Protect & Monitor Resources, and Mitigate Environmental Damage* (Mr. Curtis Bowling)
- *Reasonable Military Actions for Mitigating Environmental Damage* (MG Dennis K. Jackson, Director of Logistics, CCJ4, USCENTCOM)
- *Turkey Earthquake* (BG Ali Fuat Sarac, Turkish Army)
- *Military Environmental Stewardship in the Philippines* (COL Victor Corpus, Philippines)

11:30 LUNCH

13:00 Session IV: *National Focus: Military Response & Support to Civilian Authorities (RADM Gaidis A. Zeibots, Latvia)*

- *Hurricane Mitch Scene Setter* (DR. William Bertrand, Tulane University)
- *Disaster Response Planning* (Mr. Wolfgang Krajic, Euro-Atlantic Disaster Response Coordination Center [EADRCC])
- *Military Support to Civilian Authorities* (COL Bruce Bodin, Chief of Staff, Arizona Army National Guard)
- *Military Medical Support Capabilities* (CDR Michael J. Sircy, Deputy Force Surgeon, NAVCENT)

15:15 BREAK

15:30 Session V: *CMX Introduction & Scenario Scene Setter (Prof. B.F. Griffard, Center for Strategic Leadership, USAWC)*

16:30 George C. Marshall European Center for Security Studies Overview *COL Franz-Xaver Lauterer, Director, Conference Center*

16:45 Participant Interface Activities/DENIX Demonstration

17:45 Bavarian Dinner

Day 3 (8 March 2001)

08:30 **Azimuth Setting**

08:35 **Session V: *CMX Execution in Sub-Groups***
(Prof. Griffard)

- *08:35 – 09:30: Move One*
- *09:30 – 10:30: Move Two*
- *10:30 – 11:00: Backbrief Preparation*

*(09:30 – 11:00 Environmental Security International
Advisory Panel)*

11:00 ***Session Briefbacks (10 minutes/Subgroup);
Discussion Period*** (Dr. Butts)

- *CMTs address regional defense cooperation capabilities with regards to their particular issue*

12:30 ***Conference Summary – “The Road Ahead”***
(Dr. Butts)

12:45 ***Closing Remarks***

- *COL Franz-Xaver Lauterer, Director, Conference Center, George C. Marshall European Center for Security Studies*
- *Rear Admiral Jay A. Campbell, Director of Plans and Policy (CCJ5), US Central Command*

13:00 ***Conference Closes***