



A TEACHER'S
RESOURCE GUIDE TO

FIRES *of* KUWAIT

FILMED IN
IMAX®

FIRES *of* KUWAIT

INTRODUCTION

On August 2, 1990, Iraq's army invaded the neighboring country of Kuwait, provoking the Persian Gulf War in early 1991. After just six weeks, Iraq's forces surrendered to the international coalition that had formed to enforce the United Nations' resolutions against Iraq's actions. Although the war lasted only a short time, the damage that was inflicted on the entire Persian Gulf region, and the environmental consequences, would be felt far beyond the borders of the country of Kuwait.

On March 6, 1991, six days after the war ended, teams of firefighting specialists from the United States arrived in Kuwait to assess the damage to the hundreds of oil wells, detonated by Iraq's retreating armies, that were burning out of control. The black clouds of poisonous smoke completely obliterated the sun for weeks, and large areas of the delicate desert ecosystem were smothered by the lakes of oil that covered the sand.

This FIRES OF KUWAIT Teacher's Resource Guide has been developed by Lifetime Learning Systems for Imax Corporation for use with the IMAX® / OMNIMAX® film FIRES OF KUWAIT. This educational program is designed to enable your students to understand and appreciate the international effort that was undertaken to extinguish the oil well fires. The global commitment to this goal represented the largest international coalition in peacetime history and reflected the importance of both a healthy environment and the world's oil reserves.

The four reproducible activity masters introduce students to a range of subjects related in the film's theme including the workings of an oil well, the science and dangers of oil well fires, the environmental impact and the perils faced by the firefighters.

PROGRAM OBJECTIVES

This program is designed to accomplish the following objectives:

- To help students comprehend the imposing task faced by firefighters who extinguished the Kuwaiti oil field fires.
- To describe the basic design and operation of a modern oil well.
- To explain how an oil fire starts, how it is sustained, and the various strategies and tactics used to extinguish the more than 600 oil wells set afire in Kuwait.
- To explore the ecological implications of these oil well fires.
- To provide students with background information, activities and discussion topics to make the viewing of FIRES OF KUWAIT a valuable educational experience.

TARGET AUDIENCE

The FIRES OF KUWAIT Teacher's Resource Guide has been developed for use by students between the ages of 7 and 17 who view FIRES OF KUWAIT with their science or social studies classes in local IMAX and OMNIMAX theaters.

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ONE WELL AT A TIME

This first activity provides a framework through which students can comprehend the scale of the efforts made to extinguish the oil well fires in Kuwait by providing them with an appreciation of the value of a single oil well. Please read the introduction to this and each subsequent activity with the class before beginning the exercise.

In the first part of the activity, students should review the preparation that goes into the drilling of a single well, then explore the basic components of an oil well by matching the labelled parts of a rotary-drilling rig with brief descriptions of their functions. In Part 2, the students' knowledge of basic facts about petroleum, or crude oil, is challenged through a multiple-choice quiz.

As an introduction, you may want to point out that before it was invaded by Iraq in 1990, Kuwait was the fourth-largest producer of oil in the Middle East. The Iraqi occupation of Kuwait, the subsequent war to liberate it and the destructive retreat of Iraqi forces left the country in ruins. Kuwait's many oil fields — areas which contained vast deposits of petroleum underground, and hundreds of oil wells, refineries and storage areas above ground — were laid waste. Hundreds of wells were detonated, and the resulting fires inflicted tremendous ecological damage on the Kuwaiti desert and its environs.

When international teams began the formidable task of putting out the more than 600 oil fires and repairing the damage, they had to proceed one well at a time. This activity focuses on the important value of a single oil well, which represents the great difficulty and expense involved in drilling for oil.

Answers

PART 1

Parts should be labeled as follows:

- derrick - 1
- traveling block - 2
- bit - 3
- drill pipe - 4
- rotary table - 5
- mud pump - 6
- crown block - 7
- casing - 8

PART 2

- 1. a
- 2. c
- 3. b
- 4. a, b, c
- 5. a
- 6. c

Follow-up Activities

1. After completing Part I, have students divide into small groups to create a series of drawings that show the development of an oil well. Encourage them to do additional research into both the drilling and the operation of an oil well, and then choose several major aspects to illustrate. When completed and appropriately captioned, these can be displayed on a classroom wall or be photocopied (and reduced if necessary) for distribution to the class.

2. Encourage students to choose the multiple-choice question in Part 2 that particularly interests them and do further research on that topic. (Refer students to the section on petroleum in the resource list at the end of this guide). Schedule a time when they can report back to the class with their findings.

ONE WELL AT A TIME

FIRES OF KUWAIT chronicles the international efforts in dealing with the devastation of Kuwait's oil fields after Iraqi troops retreated in 1991, setting fire to hundreds of oil wells. The firefighters faced an enormous job: extinguishing more than 600 oil well fires, one well at a time.

Although Kuwait is rich in oil deposits, each of the destroyed wells represents years of work in planning, drilling and operating them. Drilling for oil anywhere in the world is time-consuming and expensive. Before they even begin to dig, geologists and oil companies will have spent years:

Choosing a site – Identifying locations that might have oil deposits by studying rock formations, aerial photographs and seismograph readings.

Preparing the site – Clearing and leveling a site with bulldozers to make way for roads, generators, water supply systems, and living quarters for the crew.

"Rigging" up the drilling equipment – Setting up the "rig," including the derrick, which holds up the hoisting machinery and other drilling equipment; the hoisting machinery, which lowers the drill pipe into the hole and pulls it out again; and the engines that power the drill and the other machinery.

Drilling for oil is often an enormous gamble. Although advanced technology is used to find where oil may be located, nine out of ten exploratory holes drilled still come up "dry."

PART 1 On this illustration of a typical oil drilling "rig," match each labeled part shown to the description of that part given below. Write the number of the correct description in the space next to each label.

1 The steel framework, up to 160 feet (50 metres) tall, that sits over a well.

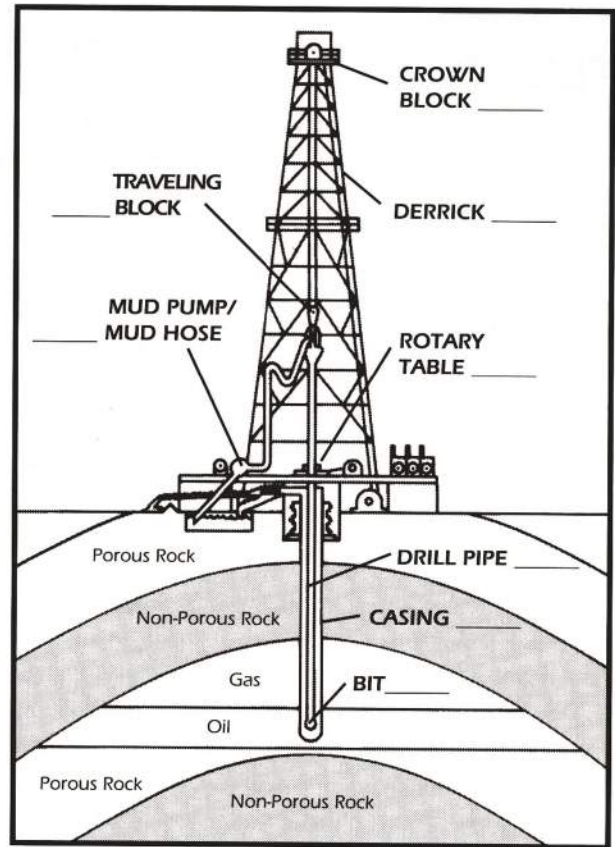
2 The moveable set of pulleys through which the rig's cable is threaded to raise and lower the drill pipe.

3 Its sharp teeth cut through rock and soil.

4 A "chain" of pipes connected to the drill bit.

5 Turns the drill pipe so it can cut through the earth.

6 Forces mud down the drill pipe to clean the hole of loose rock and soil.



7 Set of pulleys mounted at the top of the oil drilling derrick.

8 A protective lining of heavy steel pipe inside the wellbore that prevents leaks and cave-ins.

PART 2

How much do you know about petroleum, the crude oil that is produced by oil wells? Circle the letter of the answer that correctly completes each of the following statements. Be careful—some questions may have more than one right answer!

1. The Middle East has:

- more than half the world's oil deposits.
- almost all the world's oil deposits.
- fewer oil deposits than those found in North America.

2. It takes ___ of years for oil to be created.

- hundreds
- thousands
- millions

3. Most oil is found in sedimentary rock—deep beneath Earth's surface—that was created from:

- meteor showers.
- plant and animal remains.
- very cold ice-age temperatures.

4. Scientists use ___ to find oil.

- vibration measurements from a seismograph
- geological maps
- gravity measurements

5. Drilling for oil located under the ocean floor is called

- offshore drilling.
- directional drilling.
- water well drilling.

6. Deposits of ___ are generally found near oil deposits beneath the ground.

- coal
- smoke
- gas

AT THE FLASHPOINT

This activity introduces students to oil well “blow-outs” and the process by which an oil fire usually ignites and burns. They will also explore the exceptionally-dangerous problems that oil fires pose for firefighters and the methods firefighters employ to conquer these difficulties, extinguish the flames and control the well. First, an agree/disagree quiz challenges and enhances the students’ knowledge of facts concerning the scientific causes of oil fires and how they are prevented and/or extinguished.

As an introduction, you may want to discuss possible differences between oil well fires and other, more frequently encountered kinds of fires (building fires, forest fires, etc.) — how the different kinds of fires start, how firefighters approach them, etc. Then point out that oil well fires pose unique hazards to firefighters and are particularly challenging to extinguish. (Students might be interested to know that at the time of the Kuwait oil well fires, there were less than 100 professional oil well firefighters in the world!)

Part I of the activity provides a brief explanation of how oil fires start in new wells, then asks students to answer questions based on this new knowledge. Then, after viewing FIRES OF KUWAIT, students are asked in Part 2 to identify some of the particular dangers that the crews fighting the Kuwaiti fires had to face and suggest ways that each of these dangerous obstacles could be overcome.

Answers PART 1

- 1. Disagree.** “Blow-outs,” which cause most oil well fires to begin, are a fairly common occurrence when a new well is being drilled.
- 2. Agree.** Except for the situation in Kuwait and a few other instances, oil well blow-outs are generally singular accidents, the result of unequal levels of pressure within the well.
- 3. Agree.** In addition to keeping the drill bit cool and clean and removing small chips of rock and soil from the well hole, the density of the mud helps to keep the pressure equal throughout the length of the hole as it is being drilled.
- 4. Agree.** When gas — which is highly flammable — “blows out” to the surface of a newly drilled well, the threat of fire is very high, since even the heat of the drilling equipment or a spark from a hand tool is sufficient to ignite the gas.
- 5. Disagree.** Ever since the discovery of oil in the United States almost one hundred years ago, there have been oil well firefighters. Two of the most well-known, H. L. Patton and Myron Kinley, worked in the 1920s and 1930s; perhaps the most legendary is Red Adair who is still active after decades of experience.
- 6. Agree.** Controlling an oil well fire involves a number of critical steps —

cooling the site to get close enough to work on it; clearing built-up coke from around the wellhead; putting out the flames; and capping the well.

7. Disagree. The primary purpose for using water at an oil well fire is to keep the firefighters and their equipment cool enough to work close to the burning well, where the temperature may reach 2000° F. Water is sometimes used to extinguish the flames, but this is usually accomplished by separating the oil from the oxygen supply.

8. Agree. Even though it may be dangerous to use explosives around a fire, oil well firefighters sometimes use them to dislodge tons of built-up coke from the wellhead; frequently, explosives are used to “knock out” flames by rapidly depriving them of oxygen.

PART 2

Answers will vary, but may include the following factors:

- Shifting or diminishing winds that can blow flames back at firefighters and impede progress; can be avoided by working only when winds are strong and steady.
- Oil-soaked desert sands prevent vehicles and crews from approaching fire sites; roads of “gatch” clay must be built to each well.

- Danger of hitting unexploded land mines or bombs; demolition crews must clear sites before work can begin.
- Heat from flames approaching 2000° F, and superheated ground in vicinity of fire; site must be constantly cooled with water.
- Danger of explosives used to clear the wellhead of “coke”; explosives must be carefully handled to avoid accidental detonation.
- Health dangers due to the extreme heat, fatigue and clogged pores; crews must wear heat-resistant garments under their coveralls, and avoid working to the point of exhaustion.
- Constant possibility of “flashing”; care must be taken that tools do not give off sparks.

Follow-up Activities

1. After they have completed the activity sheet, have the students take it home to test their family members’ knowledge of oil well fires.
2. Oil well firefighters had never before encountered as large a number of burning wells as they faced in Kuwait; this led them to look for new ways to effectively stop the fires. Ask the students to cite specific examples from FIRES OF KUWAIT of innovations developed and used by firefighting teams in the desert to offset the obstacles they faced in trying to control the oil well fires.

AT THE FLASHPOINT

Featuring spectacular footage taken with large-format IMAX® cameras, FIRES OF KUWAIT shows just a few of more than 600 oil well fires that raged in the wake of the Persian Gulf War. Special firefighting teams have been extinguishing oil fires for decades. They had never before faced the extraordinary task that confronted them in Kuwait — putting out hundreds of wells that were blazing out of control.

Until Kuwait, oil well fires resulting from deliberate action were extremely rare, although accidental fires are fairly common. Most usually ignite during the drilling of a new well, the result of a “blow-out” — which occurs when the drill reaches an area where the gas or oil pressure is greater than that in the wellbore (the well hole). The gas or oil from this area then “blows out” at the top of the wellbore, where the hot machinery — or even a spark from a tool as small as a wrench — can easily set the highly flammable gas, and in turn, the oil, on fire.

Once a fire has started, the oil and gas will burn quickly and at extremely high temperatures — around 2000° F. Only by dousing the fire with water to greatly reduce the temperature can firefighters even approach the site. In the case of the Kuwait oil fires which had been burning for months, the buildup of oil residue, or coke, around the wellhead must be cleared, often with explosives. Then, only by separating the fuel from the oxygen supply — or knocking out the flames with explosives — can the fire be extinguished. Firefighters must then guard against the danger of sparks, which can cause the fire to flash, or reignite, around them, and then must “cap” the well to stop the flow of oil.

Answers

PART 1

Basing your responses on what you’ve already learned about oil well fires, tell whether you agree or disagree with each of the following statements. Place a check mark in the correct column to show your answer.

	AGREE	DISAGREE
1. An oil well fire is a rare occurrence.	<input type="checkbox"/>	<input type="checkbox"/>
2. The oil well fires in Kuwait were unusual in that they were intentionally set as a result of war.	<input type="checkbox"/>	<input type="checkbox"/>
3. The mud that is pumped into a well as it is being drilled helps to prevent a blow out.	<input type="checkbox"/>	<input type="checkbox"/>
4. When gas is present at the surface of a newly-drilled well, fire is a constant threat.	<input type="checkbox"/>	<input type="checkbox"/>
5. Only in the last decade have firefighters known how to control oil well fires.	<input type="checkbox"/>	<input type="checkbox"/>
6. Putting out the flames is only one step in controlling an oil well fire.	<input type="checkbox"/>	<input type="checkbox"/>
7. The primary purpose for using water on an oil fire is to put the flames out.	<input type="checkbox"/>	<input type="checkbox"/>
8. Explosives are often used to fight an oil well fire.	<input type="checkbox"/>	<input type="checkbox"/>

PART 2

As FIRES OF KUWAIT illustrates, the oil firefighting specialists in Kuwait, like firefighters everywhere, faced constant danger. But a variety of factors — including the geography and climate of the country, the debris from the war, the huge number of burning wells and the very nature of oil fires — made their task especially difficult and dangerous. After viewing the film yourself, list in the space below some of the specific dangers these firefighters faced. Then suggest a way in which each dangerous obstacle might be avoided or overcome.

SPECIFIC DANGER	POSSIBLE SOLUTION
1.
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2.
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3.
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4.
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THE INFERNO

This activity focuses on the dire environmental consequences of the Kuwaiti oil fires. Part 1 presents students with specific examples of environmental damage observed in Kuwait after the Gulf War; they are challenged to speculate on the cause of each example, and evaluate it in terms of the kind of pollution it represents. In Part 2, students are asked to tell which instances of environmental damage they feel are of the utmost priority to control, explaining their reasons and offering possible solutions.

As an introduction to the activity, ask students to describe the images they saw in the film that depicted Kuwait following the Iraqi retreat in 1991. Acknowledge their descriptions of such devastation as the burning oil wells, smoky skies, tar-covered desert sand and the oil-soaked Persian (Arabian) Gulf. Then ask them to consider the pollution that would result from these types of occurrences. Have them name specific ways in which the Kuwaiti environment, citizens or wildlife were harmed during the war, and speculate on what may have happened if the fires were allowed to continue to burn.

PART 1

Answers will vary, but may include the following:

1. **“Pitch-black” skies:** caused by tons of oil soot in atmosphere; represents air pollution, health and wildlife danger, climatic disruption.
2. **“Lakes of oil “:** caused by millions of gallons of crude oil gushing from damaged wells and pipelines; represents soil and water pollution, wildlife danger.
3. **Thousands of dead birds:** caused by migratory birds becoming fouled in water polluted by spilled oil, or by attempting to swim and drink in pools of oil mistaken for water; represents water and soil pollution, habitat destruction, wildlife and health danger.
4. **Undetonated mines:** left behind after Operation Desert Storm; represents soil pollution, health danger, public safety.
5. **Trees and Vegetation covered in oil:** caused by oil spillage from damaged wells, fallout from fires; represents air and soil pollution, wildlife and health danger.

6. Blackened Persian Gulf shoreline:

caused by oil deliberately pumped into the Persian Gulf by Iraqi forces, and damage to pipelines; represents water and soil pollution, health and wildlife danger.

7. **“Black rain”:** caused by fallout from oil fires; represents air and soil pollution, wildlife and health danger, climatic disruption.

8. **Tons of poisonous smoke:** caused by hundreds of oil well fires; represents air, water and soil pollution, health and wildlife danger, climatic disruption, contributes to global warming.

9. **“Greening” of the desert:** caused by sulfated hydrocarbons — which can stimulate plant growth — “raining” down on the desert as a result of the oil fires; also, new green shoots from intact plant roots replaced surface growth that had been killed by the layer of oil covering the desert; represents air, groundwater and soil pollution, contributes to global warming.

Follow-up Activities

1. The fires in the Kuwaiti oil fields created a potentially serious environmental crisis for the entire world. Some people, however, believe that a crisis offers both danger and opportunity (this is the ancient Chinese meaning of “crisis”). Talk with the students about the dangers posed by the burning oil fields and ask them to suggest ways in which this crisis could lead to new opportunities for Kuwait and its citizens.
2. Point out to students that the length of time needed to stop the oil well fires (nine months) was far shorter than had originally been predicted (some said five to ten years), and that the extent of resultant environmental damage may have been overestimated. Encourage students to choose one type of environmental destruction that was experienced in Kuwait, and research how that problem was treated and what the situation is today.
3. Have students investigate the long-term effects of the firefighting efforts on the fragile desert ecology of Kuwait, such as “salinization” from the huge amounts of salt water piped in to help put out the oil well fires, and the subsequent unusual “greening” that has been reported in some areas of the Kuwaiti desert.

THE INFERNO

"Everywhere you looked there was a burning well. Everywhere you looked there was nothing but destruction." With these words, a member of the first group of firefighters to arrive in Kuwait from the United States — just six days after the war ended — described what he saw. The job he and his colleagues faced was a monumental one. First they had to evaluate the damage, then help initiate the international efforts to put out the fires and save the oil fields, which are shown on this map of Kuwait and its Persian Gulf neighbors.





The Wild Well Control team backs a stinger towards well. Monitor sheds in the background shield the firefighters from the intense heat.



A Texan firefighting team takes cover when dynamite is used to dislodge built-up coke from the well head.

A hollow steel chimney called a Venturi tube draws the fire up and away from the men who must work on the well head below.

THE INFERNO

PART 1

The devastation that these firefighters found included severe pollution of the area's air, soil and water, which threatened to endanger the health of both humans and animals for generations to come.

Specific examples of environmental damage found in post-war Kuwait are listed below. After each example, tell what might have caused the situation, and what type of pollution (of the air, water,

soil, groundwater, etc.) or other environmental danger (habitat destruction, disruption of climate, global warming, danger to human health and wildlife, etc.) it represents.

DAMAGE FOUND IN KUWAIT	CAUSE OF DAMAGE	TYPE OF POLLUTION
1. "Pitch-black" skies, even at mid-day
2. "Lakes of oil" on the desert sands
3. Thousands of dead birds covered with oil
4. Undetonated mines and unexploded bombs under the sand
5. Oil-soaked trees and vegetation everywhere
6. Hundreds of miles of blackened Persian Gulf shoreline
7. "Black rain" deposited over nearly 75% of Kuwait's desert
8. Tons of poisonous smoke fouling the atmosphere daily
9. The unusual "greening" of the desert (sudden sprouting of vegetation)

PART 2

After you've seen FIRES OF KUWAIT, imagine that you were among the first teams of firefighters and support crews to arrive in Kuwait.

You have made a list of the kinds of environmental damage you have found. Now, choose the three examples of damage that you think are the most important to control immediately, and list them below.

Then explain your reasons for making each of those problems a priority, and what your recommendations for solving each problem might be.

EXAMPLES OF ENVIRONMENTAL DAMAGE TO KUWAIT	MY REASONS AND RECOMMENDATIONS
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THE OIL FLOWS ON

Students will examine in this final activity a secondary objective of the international effort to put out the fires — saving a sizable portion of the world’s petroleum supply. In Part I, students will evaluate the importance of oil to our highly-industrialized society by citing examples of its use in their own classroom. In Part 2 they will consider how their own lives would be different if petroleum products were not available, and in Part III they are asked to examine the reasons why the burning oil fields in Kuwait — the fourth-largest producer of oil in the Middle East before the war — became an economic as well as an environmental priority.

You may want to introduce this activity with a class discussion on the role that natural resources play in the students’ lives. What natural resources do students think are important? What products are made from these resources? When students have suggested a number of resources and products made from them, ask them to consider which resources hold the greatest value for them. Petroleum and the products made from it are likely to appear on many students’ lists; this final activity will help students better understand the importance of oil to our society.

Follow-up Activities

1. Encourage students to do a petroleum-product survey of their own homes. Have them make a list all the petroleum-based items they can find, and then indicate which items they feel are absolutely essential to their lives.
2. Ask students to imagine that they are members of an international committee meeting to discuss the future of the Persian Gulf region during the war. Have them role-play how they would have responded when the Iraqis began blowing up the Kuwait oil fields. What would they have done in response to this situation? Help students conduct a mock international debate over the Iraqi destruction of Kuwait’s oil industry and how to deal with it.

THE OIL FLOWS ON

People all over the world were appalled by the devastation suffered by Kuwait during its occupation and the subsequent Iraqi retreat, spurring many nations to cooperate in helping restore the country's crippled oil operations. Hundreds of firefighters and some 10,000 support workers from 40 countries joined in the effort to put out the fires and cap the wells. Hundreds of persons are still involved in cleaning up the environmental damage and making the wells fully operational again.

The international effort to extinguish the fires of Kuwait was the largest non-military mobilization in history — prompted by the fires' threat to both the Earth's environment and its supply of petroleum, the most valuable natural resource in the world today.

Although we often think of it primarily as a fuel source, petroleum is used for much more than gasoline and heating oil. It is also used to manufacture cosmetics, detergents, fertilizers, food additives, ink, medications, paint, plastics, and synthetic fabrics. Of all our natural resources, petroleum can be made into the greatest number of products — and just how many may surprise you.

PART 1

Take a few minutes to look around your classroom. Find as many items as you can that were made from petroleum. Then list them in the spaces below.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

PART 2

Now, think about how different your life would be if nothing made from petroleum were available. In the spaces below, list three effects on your life at home or at school that would occur if you could not obtain petroleum-based products.

1.
2.
3.

PART 3

Just six days after the end of the Persian Gulf War, firefighters from the United States arrived in Kuwait to begin putting out the fires and salvaging what little was left of the Kuwaiti oil industry. Although it was thought that it could take five or ten years to put out all the fires, the task was actually accomplished in just nine months. All told, Kuwait spent nearly \$2 billion on the effort.

What made such an international achievement possible?

On a separate piece of paper, give several reasons why you think the world was able to cooperate so effectively in bringing the burning Kuwaiti oil fields under control.



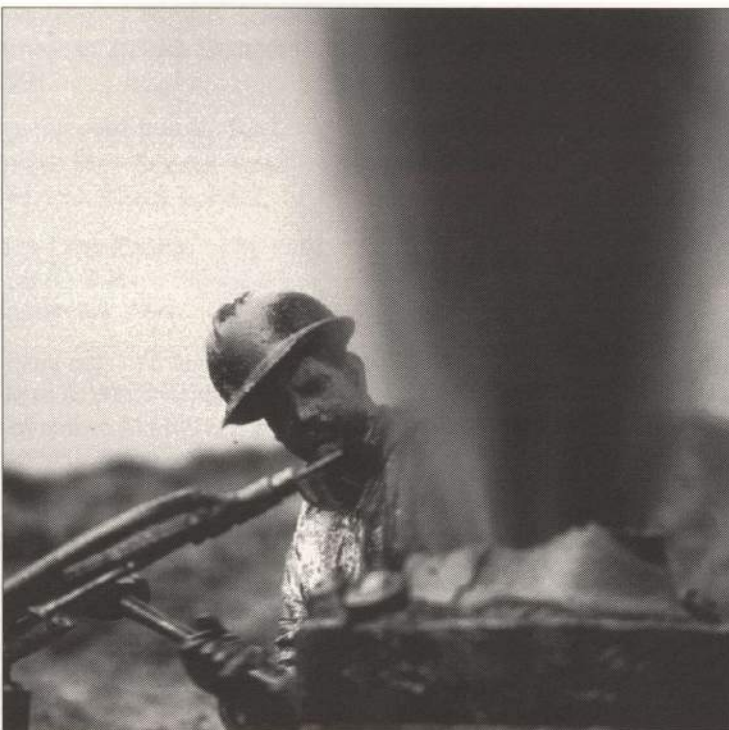
A wind change forces the Kuwaiti team into an emergency withdrawal, as 2000 degrees of blazing fire begins to lean down on them.

Unable to walk on the tarred surface of the sand, a bomb disposal team rides the fenders of a Land Rover, scanning the approaches to the wells for unexploded coalition bombs.





The Kuwaiti team wrestles with a high pressure water monitor to blast baked on "coke" away from the well head.



The Kuwaiti Wild Well Killers included the only female firefighter, Petroleum Engineer Sara Akbar.

Considered to be the most dangerous stage of well control because of the threat of re-ignition, an American well capper works quickly to remove the damaged well head.

- 1.** Talk with students about basic petroleum consumption facts. Petroleum supplies about half the energy consumed in the United States, which is the larger oil consumer on a per capita basis in the world. Given the importance of oil to western society, ask the students to consider what they would be willing to give up if an environmental disaster such as the burning of oil fields were to occur again.
- 2.** One of the firefighters who helped put out the oil well fires in Kuwait said that the experience taught her that “teamwork is the best way to go about things.” Ask students to give other examples, both in their personal lives and on a larger scale, when they have learned this lesson. Then ask them how this concept might apply to governmental leaders on local, state and national levels.
- 3.** Encourage students to research the history of the petroleum industry in the United States or their own country and the role it has played in their country’s economic and industrial development. Point out that although humans have used oil for thousands of years, its real value wasn’t recognized until about a century ago when the kerosene lamp and the internal combustion engine were invented.
- 4.** Invite a local firefighter to visit the class to talk about the firefighting techniques and equipment employed in the community, and about the special hazards and challenges of putting out a fire that involves oil or gas.
- 5.** Have students conduct an ongoing “media watch” for items relating to the aftermath of the fires of Kuwait and other environmental consequences of the Persian Gulf War. They can “collect “ and report on newspaper or magazine articles, radio or TV news features, books, video documentaries, etc. that discuss the effects of war on Kuwait, its Persian Gulf neighbors or the world at large.

The following materials can provide further information about the dangers and damage produced by the Kuwaiti oil well fires, and other related topics explored in this Teacher's Resource Guide.

ARTICLES:

(on the oilfires of Kuwait or its aftermath)

"After the Inferno." J. Horgan. *Scientific American* 266:20. January 1992.

"After the Storm." T.Y. Canby. *National Geographic* 180:2-35. August 1991.

"Airborne Studies of the Smoke from the Kuwait Oil Fires." P.V. Hobbs and L. F. Radke. *Science* 256:987-91. May 15, 1992.

"Battle Under the Sand." W.J. Cook. *US News & World Report* 110:28. March 11, 1991.

"Black Mischief." *National Review* 43:18-19. February 25, 1991.

"Blasting Down to the Wire." J. Schwartz. *Newsweek* 117:38-9. March 4, 1991.

"Burning Questions: Scientists Launch Studies of Kuwait's Oil Fires." J. Horgan. *Scientific American* 265:17. October 1991.

"The Danger from Kuwait's Air Pollution." J. Horgan. *Scientific American* 265:30. October 1991.

"Debris from Kuwaiti Fires Travels Far." *Science News* 141:159. March 7, 1992.

"Fire Over Kuwait." J.M. Kelly. *Popular Science* 237:62-65. September 1991.

"Flameout." A. Bernstein. *US News & World Report* 111:16. November 11, 1991.

"Getting Blacker Every Day." E. Linden. *Time* 137:50-51. May 27, 1991.

"Gulf Oil Threatens Ecology, Maybe Climate." J. Raloff and R. Monastersky. *Science News* 139:71. February 2, 1991.

"Hellfighters to the Rescue."

C. Leerhsen and S. Begley. *Newsweek* 117:27. March 25, 1991.

"Hot! Conquering Oil Fires." R. Bankson. *National Geographic World* 201:12-16. May 1992.

"A Legacy of War." J. Travis. *Science News* 140:24-6. July 13, 1991.

"'Nuclear Winter' from Gulf War Discounted." E. Marshall. *Science* 251:372. January 25, 1991.

"Satellite Depicts Kuwaiti Oil-Well Fires." *Science News* 139:197. March 30, 1991.

"Satellite Observations of Smoke from Oil Fires in Kuwait." S.S. Limaye and others. *Science* 252:1536-9. January 14, 1991.

"Shock Therapy." D. Stover. *Popular Science* 239:33. October 1991.

"Taking Stock of Saddam's Fiery Legacy in Kuwait." M. Hoffman. *Science* 253:971. August 30, 1991.

BOOKS:

(on the Persian Gulf region and Kuwait)

Aramco and its World: Arabia and the Middle East ; P.F. Hoye, I.I. Nawwas and Peter C. Speers, ed. Washington, DC: Arabian American Oil Company, 1980 (and subsequent editions).

Persian Gulf States: Country Studies ; American University Area Handbook series. Washington, DC: U.S. Government Printing Office, 1984 (and subsequent editions).

(on the environmental effects of the invasion of Kuwait)

The Iraqi Invasion of Kuwait: An Environmental Catastrophe by Prof. Jassim Mohammed Al-Hassan; Kuwait University, 1992.

(on the international petroleum industry)

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(on oil firefighting)

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ACKNOWLEDGEMENTS AND CREDITS

This Teacher's Resource Guide for FIRES OF KUWAIT was produced by Lifetime Learning Systems Inc. for Imax Corporation.

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FIRES OF KUWAIT was produced by Black Sun Films Ltd., a subsidiary of Imax Corporation.

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