



PUBLIC HEALTH IMPLICATIONS OF HYDRAULIC FRACTURING

SUNY UPSTATE MEDICAL UNIVERSITY
April 13, 2011

Factors Affecting the Shift to Shale Gas

- Push toward alternative fuels
- Misperception that NG is a bridge fuel that is “clean”
- The profitability of exporting liquefied NG (LNG)
- Development of high volume, slick water hydraulic fracturing (old technology with new application)
- Financial incentives to extract natural gas
- Dwindling oil reserves
- 2005 Energy Policy Act

Some examples of gas extraction sites



www.un-naturalgas.org



www.un-naturalgas.org







J Henry Fair

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www.jhenryfair.com

Henry Fair

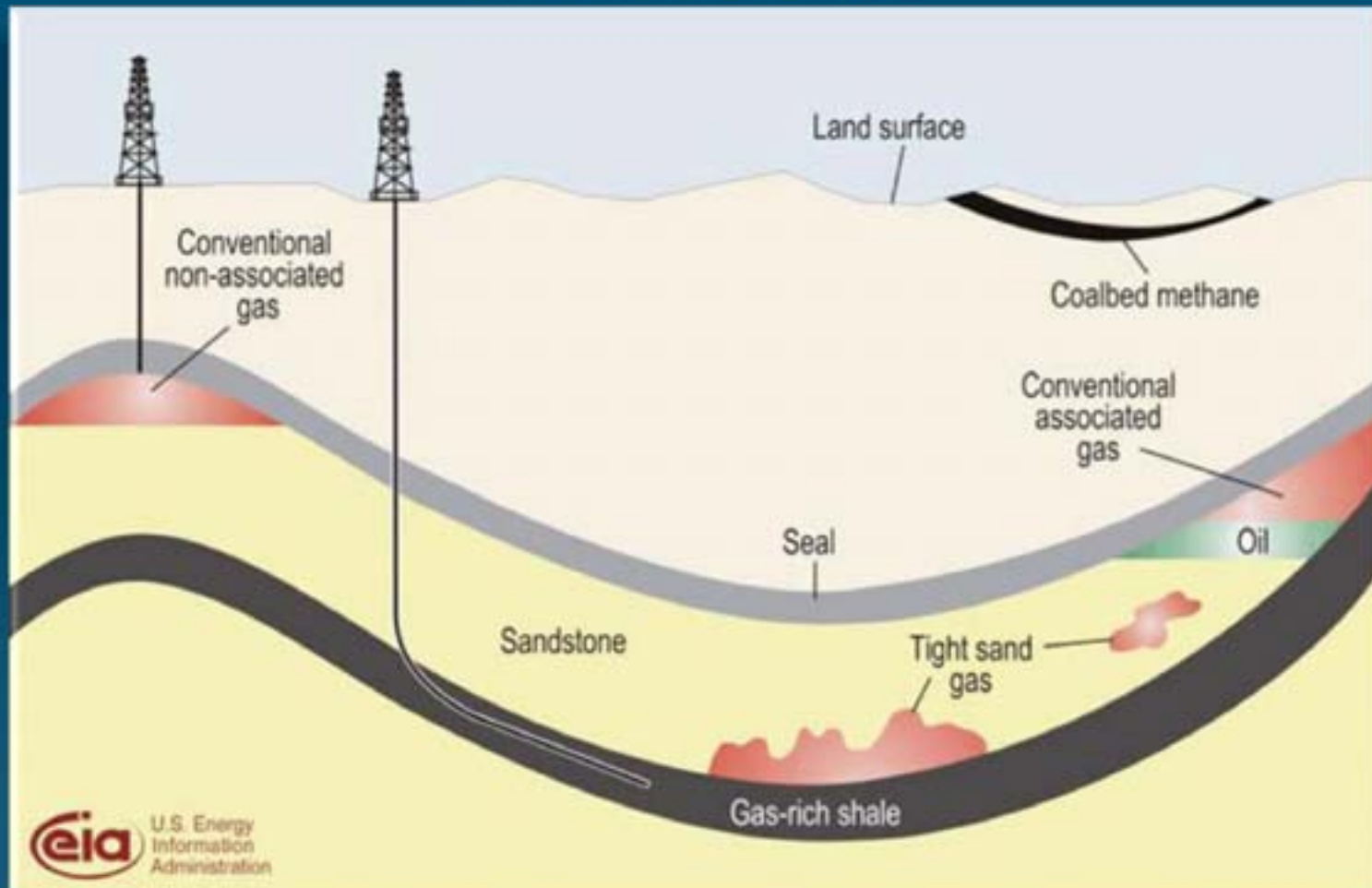


Susquehanna County, Pennsylvania

source: www.un-naturalgas.org



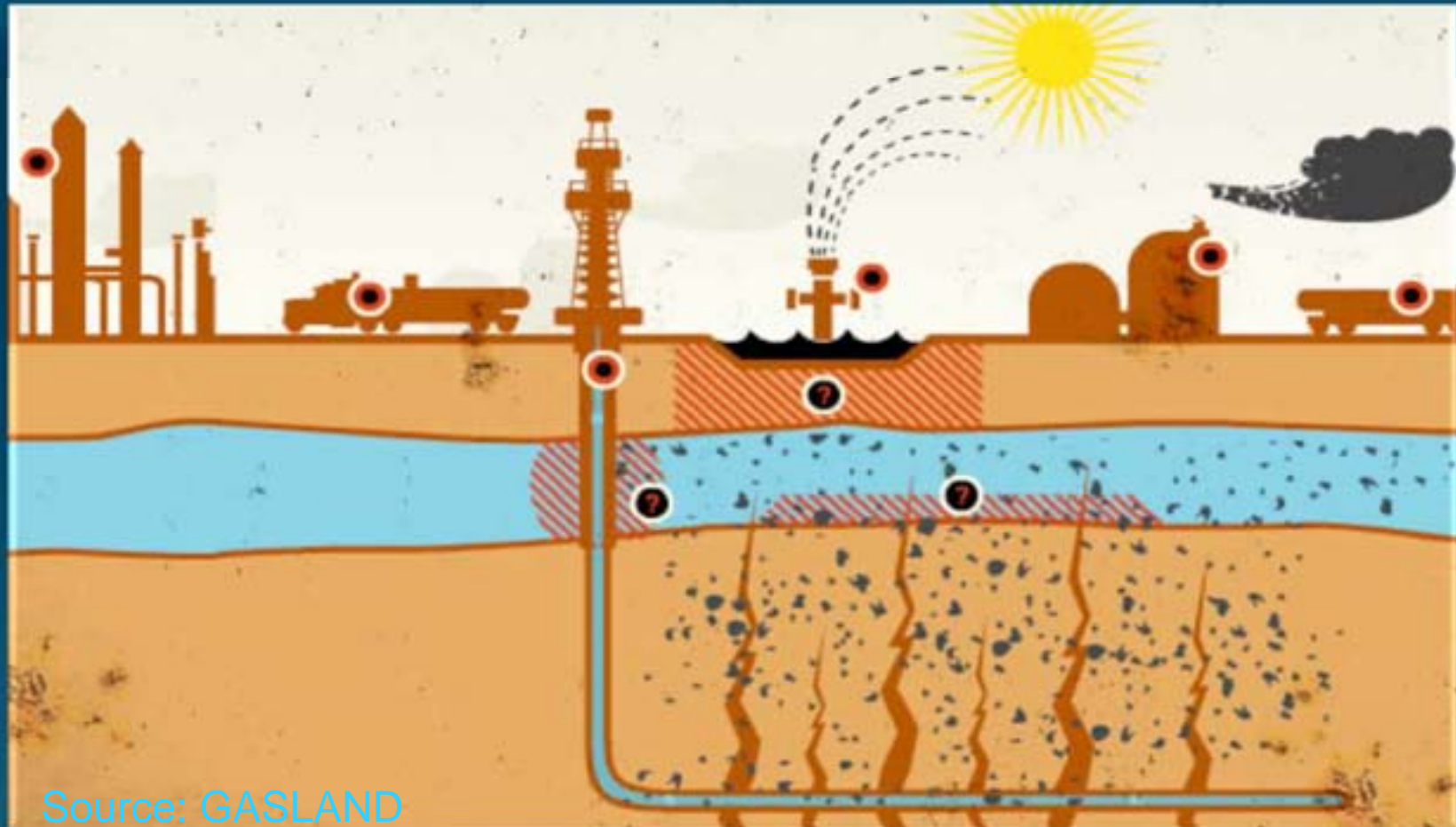
CONVENTIONAL vs. UNCONVENTIONAL GAS DRILLING



<http://www.youtube.com/watch?v=EHg6Ueb2t-E>

HYDROFRACKING

~ quantity of water withdrawn ~ transport ~ drilling
~ during and post fracking ~ storage
~ processing ~ waste disposal ~ pipeline transport



Source: GASLAND

Extent of MARCELLUS SHALE in NY State



Source: NYS Department of Environmental Conservation The Post-Standard

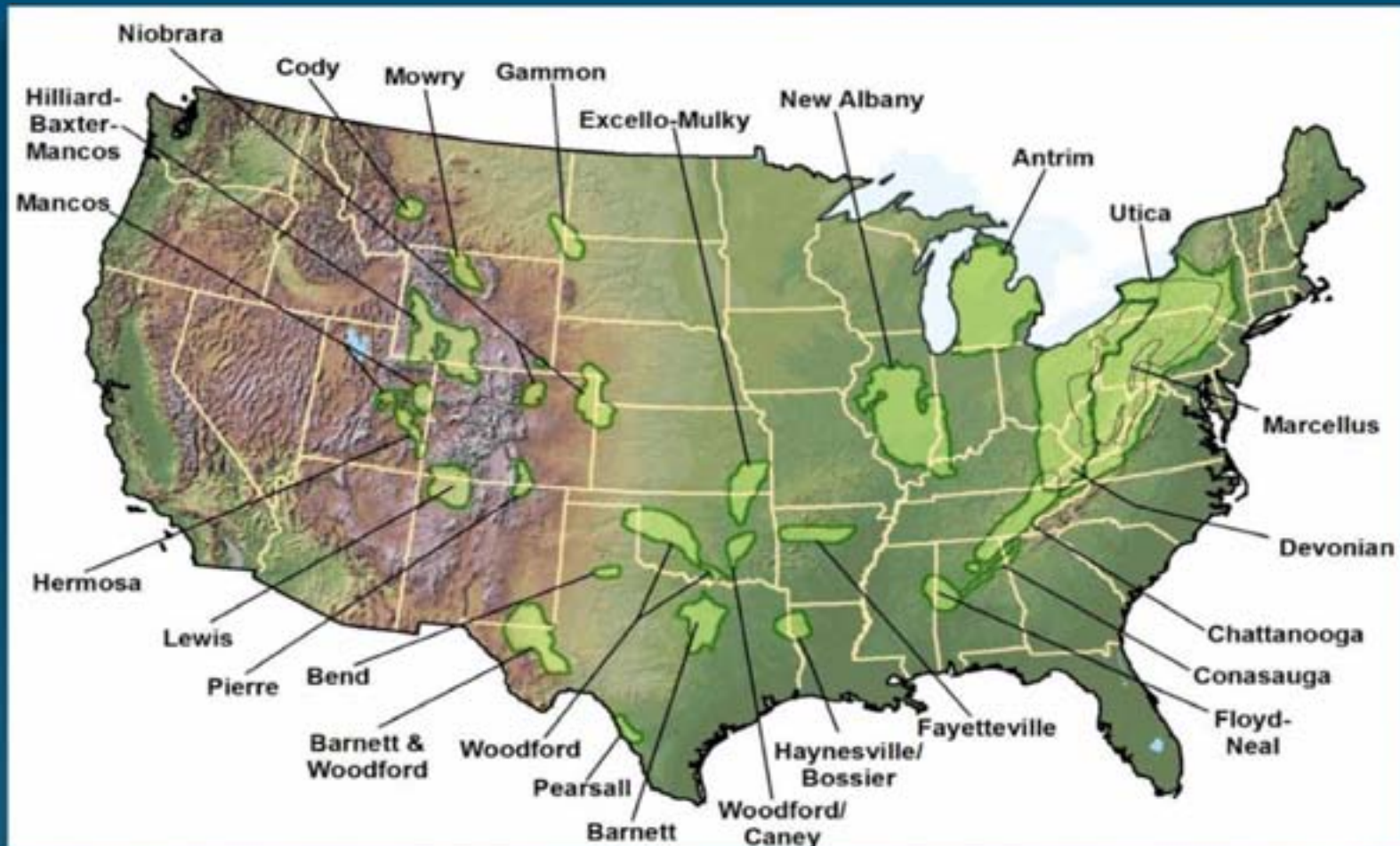
Who might be affected? People...

- ~ in areas where gas drilling occurs
- ~ near pipelines
- ~ who receive their water from gas drilling areas
- ~ who are downwind of gas producing or processing areas

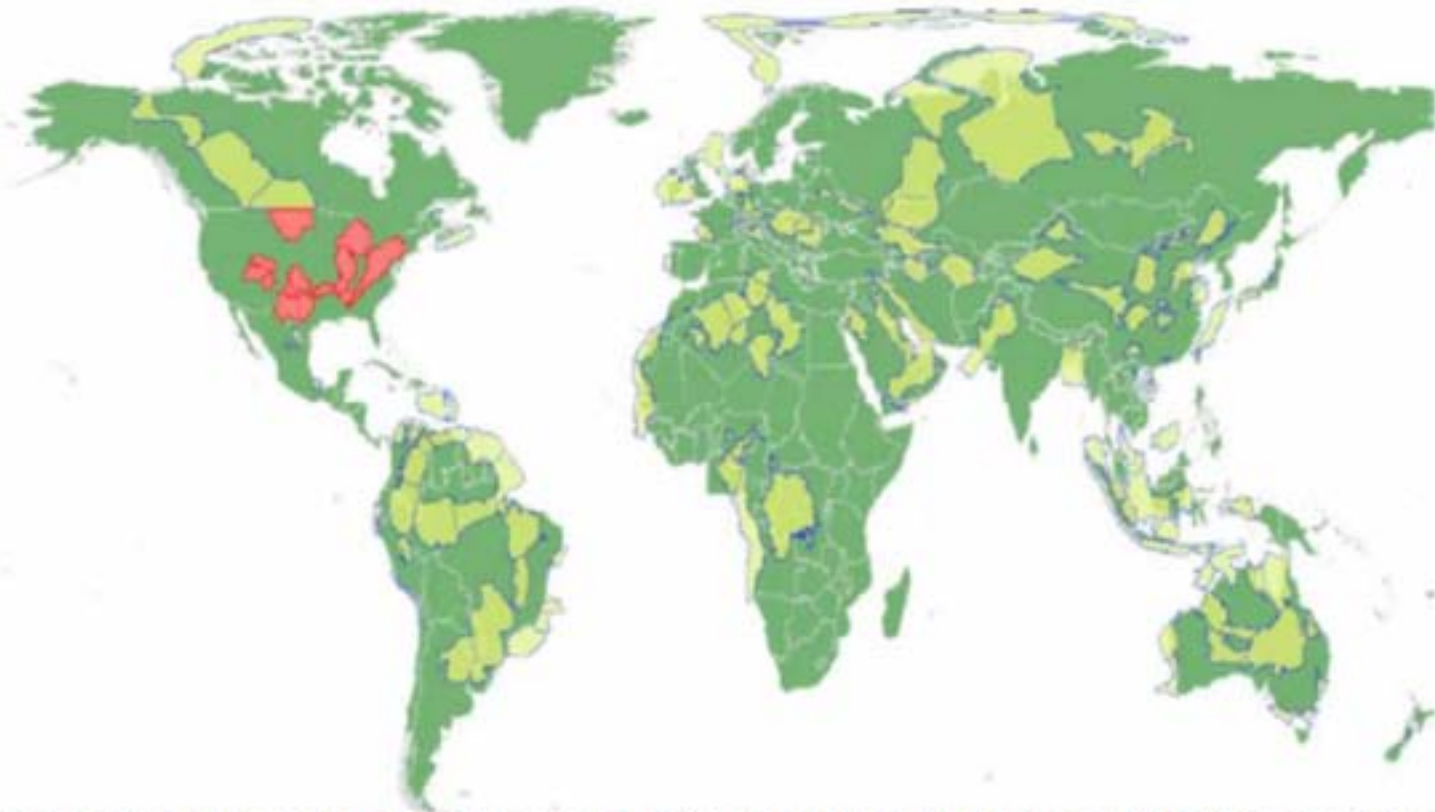
Below are TWO OF THE SEVEN SHALE PLAYS IN NEW YORK STATE



SHALE BASINS IN THE UNITED STATES



GLOBAL SHALE GAS RESOURCES



Source: Schlumberger study from 2007 presented by Schlumberger Oilfield Services at CERA Week conference in February 2009

The NYC and the Delaware River Basin Watersheds together provide water to over 15 million people—about 5% of the US population



WATER

SYRACUSE WATERSHED



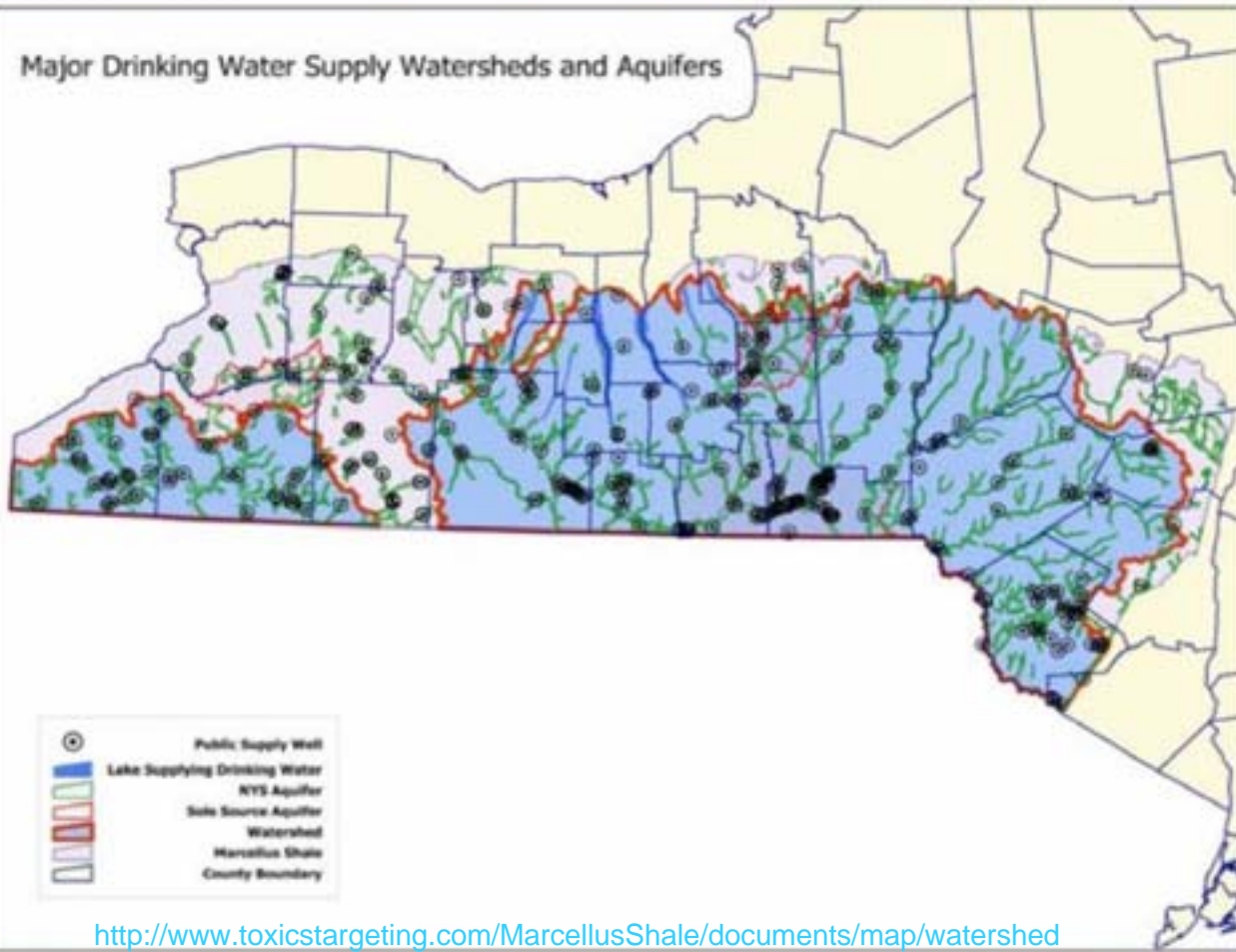
<http://www.syracuse.ny.us/Pdfs/Water%20Dept.%20web%20page%20update-2-4-04.pdf>

<http://www.nysenate.gov/news/syracuse-post-standard-ny-mulls-hydrofracking-regulations-gas-companies-lease-land-cny-watershe>

Filtration Avoidance Determinations

- The federal Safe Drinking Water Act requires that drinking water taken from surface water sources must be filtered to reduce the risk of waterborne disease. In rare instances, a FAD is granted to a water supplier if it is able to demonstrate compliance with an array of strict water quality criteria and if it effectively implements a comprehensive watershed management plan. Both [New York City](#) and the [City of Syracuse](#) have been issued a FAD for their drinking water systems. Maintaining a FAD presents unique land-use issues independent of the environmental safety of high-volume fracturing.
- As a result of this decision, applicants for natural gas drilling permits using high-volume horizontal drilling in the FAD watersheds will not be able to use the SGEIS. Instead, they will need to meet special requirements relating to the unfiltered surface water supply, including conducting individual environmental reviews to address the continuation of the FAD. DEC will work closely with DOH--which has primary jurisdiction over the FADs--local watershed communities, and cities benefiting from the FADs to develop additional drilling requirements that may be applicable in FAD watersheds.

Major Drinking Water Supply Watersheds and Aquifers



<http://www.toxicstargeting.com/MarcellusShale/documents/map/watershed>

CHEMICAL MIX

~is considered **proprietary**

~includes **known or suspected carcinogens, mutagens, endocrine disruptors, neurotoxins, hazardous air pollutants**

~many of the chemicals in these products have **effects at low doses**, and children and pregnant women should not be exposed to some at all.



AIR POLLUTION



<http://www.youtube.com/user/balckbart0930#p/u/2/sEoN-3A-zQ4> example from Dimock, PA

DRILLING WASTE DISPOSAL

- ~there is currently no safe way to process the waste
- ~waste contains radioactive elements, brine and gases

http://www.youtube.com/watch?v=tWwjWFCIgY&feature=player_detailpage



ACCIDENTS AND EXPLOSIONS

can occur at any point of gas production, from transport of gear and chemicals to the site, to construction and operation of the well, to the processing of the gas and to the delivery of it via pipelines, and at any of those points, explosions are possible



NOISE

<http://www.elkcapital.net/screaming silence/voices/Sound010.wav>

<http://www.elkcapital.net/screaming silence/>

LOSS OF VIEWSHED, FOODSHED AND
WATERSHED; SURFACE DISTURBANCE FOR
ONE WELL PAD IS 3-5 ACRES



wvsoro.org

ARE THERE POTENTIAL PUBLIC HEALTH ISSUES?

In 2004 an EPA Study on Hydrofracking was misrepresented to Congress and this resulted in Congressional passage of the 2005 Energy Policy Act

Since then, the gas industry has been exempt from several federal public health and environmental laws. What this does is reduce monitoring and data collection which would otherwise serve to alert health agents of potential problems

FEDERAL EXEMPTIONS

The oil and gas industry was granted exemptions from provisions in the major federal statutes intended to protect human health and the environment. These statutes include:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Resource Conservation and Recovery Act
- Safe Drinking Water Act
- Clean Water Act
- Clean Air Act
- National Environmental Policy Act
- Toxic Release Inventory under the Emergency Planning and Community Right-to-Know Act
- Superfund Act

<http://www.earthworksaction.org/pubs/PetroleumExemptions1c.pdf>

Highlights of Oil and Gas Industry Exemptions From Federal Statutes

http://www.citizenscampaign.org/PDFs/cce_hvhf_wp_final.pdf

- **Safe Drinking Water Act (SDWA)**

Hydraulic fracturing operations are completely exempted from regulation under SDWA and Underground Injection Control of fracking fluid was deemed to exempt it from EPA regulation of Underground Injection Control.

- **Clean Water Act (CWA)**

Expanded the definition of oil and gas operations and activities to include the construction of the drill site, waste management pits, access roads, in-field treatment plants and transportation infrastructure. Eliminated "sediment" as a pollutant in managing stormwater run-off from drill pad site and all oil and gas field construction activities and operations.

- **National Environmental Policy Act (NEPA)**

Weakened environmental review process by presuming that some oil and gas related activities should be analyzed and processed by the Interior and Agricultural Departments under categorical exclusions, which does not provide for a public comment period.

- **Comprehensive Environmental Response, Compensation and Liability Act (a.k.a. Superfund)**

The list of covered hazardous substances section 101(14) excludes crude oil and petroleum.

- **Resource Conservation and Recovery Act (RCRA)**

The Solid Waste Disposal Act of RCRA exempts oil field waste from Subchapter III of RCRA until the EPA could prove the wastes were a danger to human health and the environment. In 1980 EPA made a regulatory determination that oil field waste should be exempted because of adequate state and federal regulations. This includes produced waters, drilling fluids, and associated wastes.

- **Clean Air Act (CAA)**

The CAA states that the oil and gas industry will not be aggregated together to determine if they are subject to Maximum Achievable Control Technology for each source. The exemption also extends to pipeline compressors and pump stations in some instances.

- **Toxic Release Inventory under the Emergency Planning and Community Right-to-Know Act (EPCRA)**

The oil and gas industry is exempted from reporting under section 313 of EPCRA, even though it generally meets the requirements established for reporting.

STATE LAWS AND REGULATIONS VARY

- States can enact laws which would require compliance with all the federal health laws
- States' laws vary
- Mineral rights vs. surface rights=split estate (mostly in the West)
- States can impose severance taxes; NY and PA do not
- In NYS there is a defacto moratorium on horizontal hydrofracking until the final SGEIS is issued
- There is no mandate to perform an HIA

LOCAL LAWS

- Municipalities in NY State can regulate their zoning and road use; some towns have used the definition of home rule to enact BANS or use the law to zone out certain offensive activities, like noise, heavy industry and traffic
- HOME RULE bill A03245 /S3472 clarifies the role of municipalities in governing oil, gas, and solution mining development within their jurisdiction. This legislation clarifies that current local zoning law, and local zoning laws enacted in the future, will dictate where oil, gas, and solution mining is a permissible use, even with a regulatory program at the state level.

Eunice, NM



Allegheny, PA



PENNSYLVANIA



Role of PUBLIC HEALTH ADVOCATES—when an activity that may impact human health, such as gas drilling, is contemplated in a community

- Assess the situation
- Would a health consultation be useful?
- Any individual or group, as well as a local, county or state public health official can initiate a petition for a health consultation which could be done by the county or state health department or by ATSDR, or a school of public health, depending on resources and other factors
- All stakeholders should be encouraged to be involved
- The U.S. Institute of Medicine has defined the **field of public health** as "what we do as a society to assure the conditions in which people can be healthy." See Addressing the Social Determinants of Health Inequities: Learning from Doing. American Journal of Public Health, Vol 95(4) 553-555.
- **Be an advocate—someone's health may depend on it**

These MEDICAL ORGANIZATIONS have asked for SCIENTIFIC STUDIES PRIOR TO ISSUING REGULATIONS AND PERMITS

- American Academy of Pediatrics, District II, New York State
- Mt. Sinai Children's Environmental Health Center
- NYS Conference of Environmental Health Directors
- NYS DOH
- Bassett Healthcare Network Board of Trustees and the Medical Staff
- THE MEDICAL SOCIETIES of the NY Counties of ONEIDA, HERKIMER, BROOME, MADISON, OTSEGO, OSWEGO, CAYUGA, CHENANGO, ONONDAGA, TOMPKINS
- Medical Society of the State of New York
- EPA
- Physicians for Social Responsibility

Medical Society of the State of New York has called for a Moratorium

“RESOLVED, That the Medical Society of the State of New York supports a moratorium on natural gas extraction using high volume hydraulic fracturing in New York State until valid information is available to evaluate the process for its potential effects on human health and the environment.”

December 10, 2010

- Follow the Precautionary Principle
- Reverse the exemptions from federal environmental and public health laws
- Prohibit drilling while studies are being done and evaluated
- In NYS, give the DOH co-lead agency status on matters related to gas drilling, like the draft SGEIS
- Expand the current draft SGEIS to include human health impacts

**IS THERE A TOOL WHICH CAN
INFORM AND RECONCILE THE
POLICY AND REGULATORY
MECHANISM IN NEW YORK STATE
WITH THE SCIENCE OF PUBLIC
HEALTH?**



HIA

What is a Health Impact Assessment?

HEALTH IMPACT ASSESSMENT MAY BE DEFINED AS A COMBINATION OF PROCEDURES, METHODS AND TOOLS THAT SYSTEMATICALLY JUDGES THE POTENTIAL, AND SOMETIMES UNINTENDED, EFFECTS OF A POLICY, PLAN, PROGRAMME OR PROJECT ON THE HEALTH OF A POPULATION AND THE DISTRIBUTION OF THOSE EFFECTS WITHIN THE POPULATION. HIA IDENTIFIES APPROPRIATE ACTIONS TO MANAGE THOSE EFFECTS.

Adapted from the WHO, Gothenburg Consensus Paper 1999

http://www.hiaconnect.edu.au/files/HIA_International_Best_Practice_Principles.pdf

and why is it useful?

The practice of Health Impact Assessment (HIA) elevates the role of health in decision-making.

Health Impact Assessments are a practical tool that can provide a structured process to determine a policy or project's impact on health; bring both immediate and long term health benefits; and ensure project dollars are used efficiently to provide the highest benefit to communities. They help create healthier communities by addressing the root causes of many prominent health problems ... HIAs have demonstrated success in a variety of issue areas, ranging from land use and transportation to housing policies, labor standards, natural resource extraction, education and economic policies.

International Association for Impact Assessment



www.iaia.org/

HIAs are typically commissioned by:

- Local, regional and national governments
- Local, regional and national health authorities/departments
- Local, regional and national planning authorities/departments
- National and international development banks/ bi- and multilateral-donors
- Private industry
- Concerned citizens

Why should the HIA be done by Public Health Officers?

EIA procedures frequently do not recognize the fact that **the ultimate authority for health pertains to Departments of Health** (central or peripheral levels), which should have the regulatory responsibilities for the planning, quality control and final approval of any assessment of the impact on health and its follow-up. In that case, care needs to be taken:

- To ensure health is covered comprehensively.
- To strike an acceptable balance between strengthening of health services and design and operational measures by other sectors to safeguard health and well-being.
- To adequately address the wider determinants of health.
- To anchor the final authority for the health component with the Department of Health.

FEATURES OF AN HIA

- the aim is to maximize the health gain (and minimize the loss) that would be expected to result from a proposal, and that the latter may or may not have improving health as its aim;
- HIA should be multidisciplinary, intersectoral, and participatory, and include a focus on health inequalities;
- both quantitative and qualitative types of evidence should be used;
- the main values underlying the conduct of HIA are sustainability, the promotion of health, participation, democracy, equity, equality (of all stakeholders in the process but in particular of the community affected), and the ethical use of evidence.

STEPS OF AN HIA

- *Screening* - determining if an HIA is warranted/required
- *Scoping* - determining which impacts will be considered and the plan for the HIA
- *Identification and assessment of impacts* - determining the magnitude, nature, extent and likelihood of potential health impacts, using a variety of different methods and types of information
- *Decision-making and recommendations* - making explicit the trade-offs to be made in decision-making and formulating evidence-informed recommendations
- *Evaluation, monitoring and follow-up* - process and impact evaluation of the HIA and the monitoring and management of health impacts

<http://www.iaia.org/iaia/wiki/hia.ashx>

In more detail...

- **Screening:** Determines whether the HIA is likely to succeed and add value. Questions include: What specific proposed project, program or policy decision will the HIA address? For example, if the HIA will address a proposal for a coal-fired power plant, what specific decision-making process (such as an air-quality permit or environmental impact statement) will the HIA inform? How important to health is the decision? Will the HIA provide new and important information or insight on previously unrecognized health issues? Is it feasible in terms of available resources (e.g., data, time, money, stakeholder interest and political will)?
- **Scoping:** Creates objectives for the HIA, and an outline for the steps of the HIA process by asking: What health effects should the HIA address? What concerns have stakeholders expressed about the pending decision? Who will be affected by the policy or project, and how?
- **Assessment:** Involves two steps, describing the baseline health of people and groups affected by the decision, and then predicting the potential health effects. The baseline health analysis attempts to explain not only the important causes of illness, but also the conditions that influence health and could be affected by the decision in question—such as the local economy, air quality, availability of parks and recreation facilities, or access to healthy food choices.

The assessment stage can involve literature review, qualitative analysis and/or quantitative modeling. It identifies not only the important health risks and benefits, but also their distribution among vulnerable subgroups within the population (such as children, the elderly, people with chronic illnesses, racial and ethnic groups, or those with low incomes). The HIA should be conducted in an impartial, scientific way that identifies both the risks and the benefits associated with a decision. Assessment of health-related economic costs and benefits has not been common in HIA but decision makers sometimes request this information; when possible, such analysis may help them weigh the relative importance of identified health issues against other considerations.

Continued...

- **Recommendations:** The HIA should point the way to decisions that protect and promote health. The actions required to integrate an HIA's analysis and recommendations into a decision-making process will vary. In some cases, simply providing a thorough analysis that outlines the potential risks, benefits and costs of alternatives may help policy makers to make informed choices that support health. In many cases, however, an HIA's ability to influence outcomes will require additional efforts, including the development of specific recommendations based on the analysis, as well as a health management plan that specifies who will implement each recommendation and how outcomes will be monitored going forward. These products should provide practical, specific actions that can be taken in order to promote health and avoid, minimize or mitigate adverse consequences.
- **Reporting:** The findings are disseminated to decision makers, affected communities and other stakeholders with a request for feedback. This stage may result in a revised report that addresses public responses to the draft.

The success of an HIA depends on effective dissemination. Simply providing recommendations is often not enough to ensure their adoption or implementation. The HIA should be conducted with an eye toward the policy levers, legal or regulatory avenues, communications and non-lobbying advocacy tactics, or other methods that will ensure effective dissemination of the findings and facilitate adoption of the recommendations. For example, in some cases when public agencies conduct an HIA, it may be possible to implement its recommendations under existing laws, policies or regulations or through the creation of new policies or regulations. In other cases, media outreach and efforts to engage, educate and build consensus among all stakeholders may be essential to ensuring that HIA insights inform key policy decisions.

- **Monitoring and Evaluation:** There are three types of evaluation in HIA: 1) process evaluation gauges the HIA's quality according to established standards and the original plan for the HIA; 2) impact evaluation assesses the HIA's impact on decision-making and its success according to the objectives established during scoping; and 3) outcome evaluation assesses changes in health status and health determinants as the decision is implemented. Monitoring tracks indicators that can be used to inform process, impact and outcome evaluations.
<http://www.healthimpactproject.org/hia/process>

APHA Supports:

- A designated agency in the White House or Health and Human Services (HHS) to lead and coordinate HIA efforts in the United States
- Investment in HIA-based research, practice, and training
- Identification and implementation of an HIA research agenda
- Building of HIA capacity at local, state, and federal levels
- Grants for HIA demonstration projects
- Identification of HIA best practices
- Establishment of guidelines and standards for HIA practice

www.apha.org

EXAMPLES OF HIAs

<http://www.garfield-county.com/public-health/battlement-mesa-health-impact-assessment-ehms.aspx>

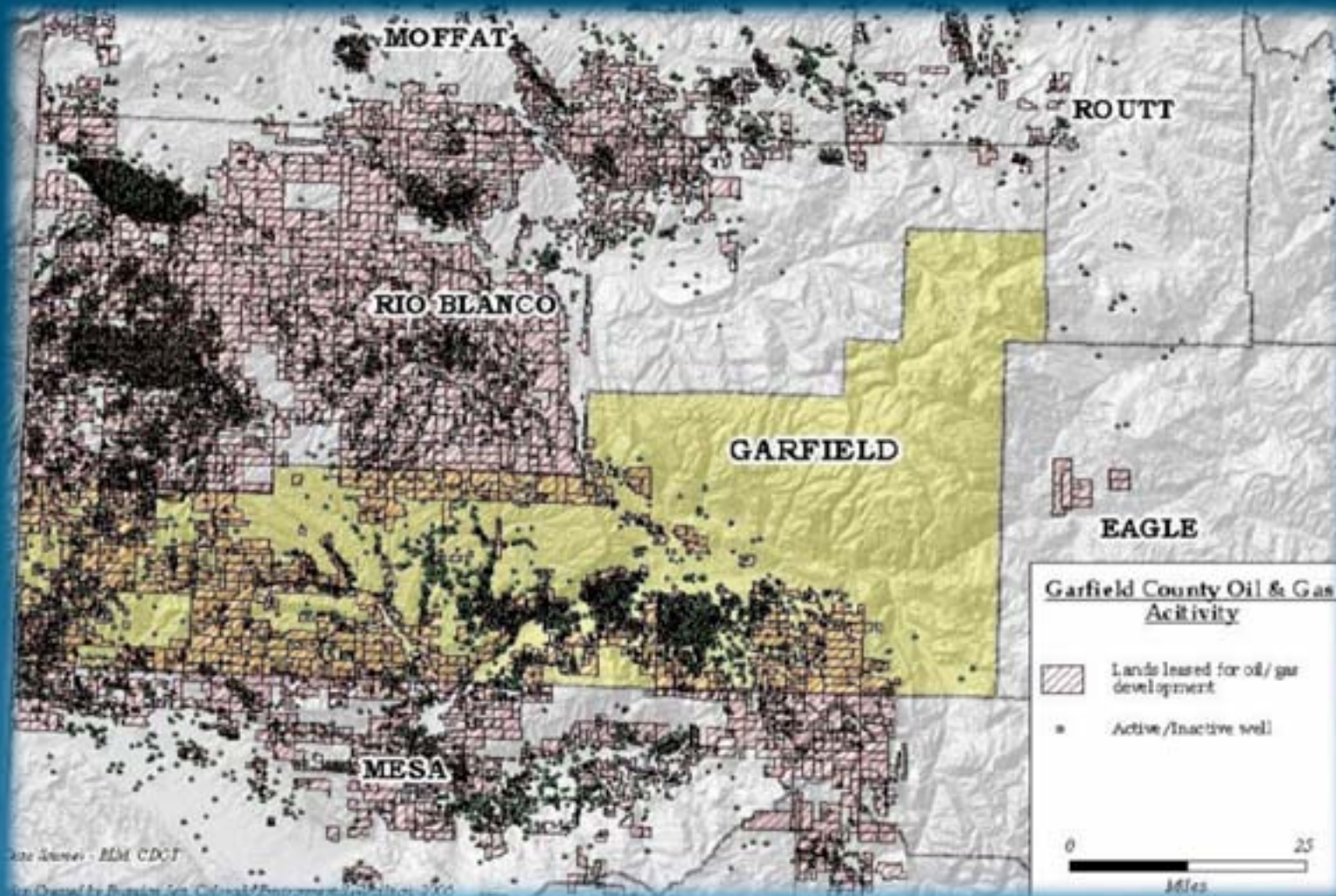
<http://www.hiaguide.org/hia/national-petroleum-reserve-alaska-oil-development-plan>

GARFIELD COUNTY, COLORADO



image:TEDX

GARFIELD COUNTY OIL & GAS ACTIVITY



Antero's plan for development in Battlement Mesa, CO



COLORADO BATTLEMENT MESA

- In May 2009, Antero Resources announced a proposed Comprehensive Development Plan that would include constructing ten well pads and drilling over 200 natural gas wells within the residential area of Battlement Mesa. Some pads could be as close as 400 feet from homes and recreation areas
- A citizens' group formed and requested a health study from the county commissioners
- ATSDR was asked by the CO DOH to do a health consultation and they found that additional monitoring of various parameters was needed
- An HIA was planned and approved by the BOCC
- In preparation for the HIA, measurements of VOCs and HAPs were undertaken by the county health department
- BOCC of Garfield County contracted with the Colorado School of Public Health in Denver to do the study
- HIA is now in the second draft
- Discussion with stakeholders including citizens, public health officials in the county and state as well as industry and Colorado Oil and Gas group is occurring now
- Document is presently open for public comment
- Cost thus far: about \$200,000 which Garfield County has provided

BATTLEMENT MESA HIA CONDUCTED BY THE COLORADO SCHOOL OF PUBLIC HEALTH SEPTEMBER 2010 TIL PRESENT

http://www.garfield-county.com/public-health/documents/BOCC_Draft_HIA_Presentation_10_4_10%5b1%5d.pdf

Assessment	Direction of health effects	Geographical Extent of exposure	Vulnerable populations	Duration of exposure	Frequency of exposure	Likelihood of health effects as a result of Project	Magnitude of health effects	Rank
Air Quality	Negative (-)	Community-wide	Yes	Long	Frequent	Likely	Moderate to High	-14.5
Water and Soil Quality	Negative (-)	Community-wide	Yes	Long	Infrequent	Unlikely	Moderate to High	-11.5
Traffic	Negative (-)	Community-wide	Yes	Long	Frequent	Possible	Low to high	-13
Noise, Vibration, Light	Negative (-)	Local	No	Long	Frequent	Possible	Low-Medium	-10.5
Community Wellness	Mixed (±)	Community-wide	Yes	Long	Infrequent	Possible	Low to Medium	± 11.5
Employment and economy	Mixed (±)	Community-wide	Yes	Long	Frequent	Unlikely	Low	±10.5
Health Infrastructure	Mixed (±)	Community-wide	Yes	Long	Infrequent	Unlikely	Low	±10
Accidents and malfunctions	Negative (-)	Local or Community-wide	Yes	Short	Infrequent	Possible	Low to high	-10

According to the Colorado School of Public Health, of the 8 stressors, the greatest impact will be a negative one; AIR POLLUTION associated with gas drilling is predicted to be the greatest stressor on health in Garfield County, Colorado; recommendations for mitigation are provided in the HIA



Image:scottgerdes

Recommendations to Protect Air Quality [http://www.garfield-county.com/public-health/documents/BOCC Draft HIA Presentation 10 4 10%5b1%5d.pdf](http://www.garfield-county.com/public-health/documents/BOCC_Draft_HIA_Presentation_10_4_10%5b1%5d.pdf)

- ØRequire submission of a quality assurance project plan (also known as a QAPP) to GCPH for review and approval for all monitoring specified in these recommendations to assure monitoring information will be adequate for informing public health decisions.
- ØRequire Antero monitoring results conducted in response to CDPHE consultation (dated 4/12/2010) be made available to the public in a timely manner to provide accessible information and transparency.
- ØRequire corrective action when odor events occur, including notification of the GCPH and residents to reduce impacts.
- ØRequire adherence to COGCC 805b green completion practices, with no variances, and EPA natural gas STAR program to reduce VOC emissions to the lowest level technically possible.
- ØRequire use of electrically powered generators in place of diesel powered generators for well drilling and fracking operations to reduce VOC, PAH, and PM emissions.
- ØRequire a valid emissions permit from the CDPHE for each well pad, per COGCC rule 805b to establish inspection and monitoring requirements.
- ØTo reduce VOC emission, require pilot lights on production tank combustors remain lit through use of appropriate technology, such as spark igniters.
- ØRequire adherence to dust control measures and traffic measures specified in the Surface Use Agreement.
- ØRequire that Antero establish and implement a plan that ensures all trucks used for its plan within the PUD meet emission standards specified in the Clean Fuel Vehicles (heavy trucks) for the Clean Fuel Fleet Program (CFR Part 88.105-94) to reduce VOC, PAH, and PM emissions.
- ØRequire truck loads of dirt, sand, aggregate materials, drilling cuttings, and similar materials be covered to reduce dust and PM emissions.
- ØRequire pits at the water storage facility to be covered to reduce VOC emissions.
- ØRequire air monitoring of water storage facility for VOC/BTEX and report results to GCPH.

Current and Proposed Oil & Gas Leases on Alaska's North Slope

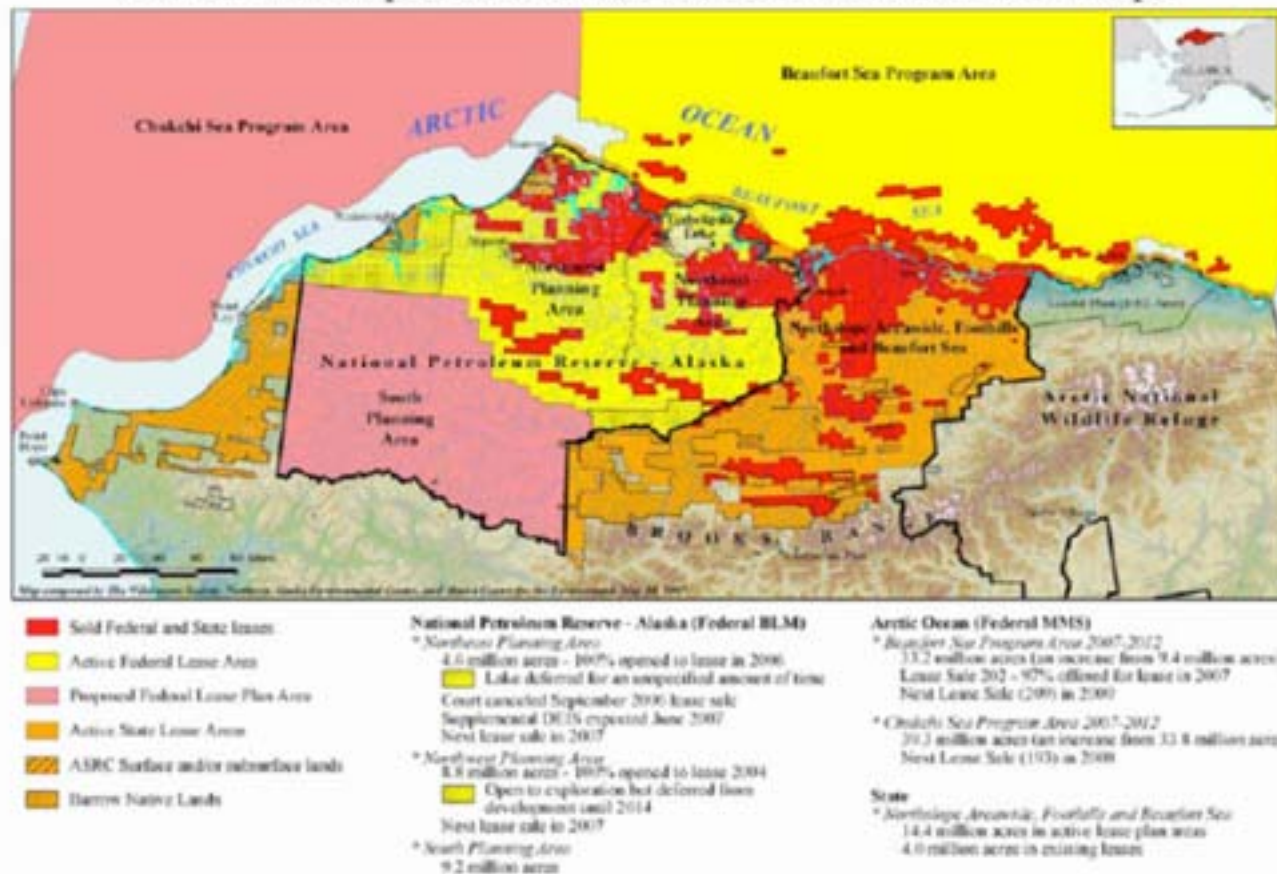


Figure 1: North Slope Oil and Gas Leases

http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/planning/ne_npra_final_supplement.Par.20725.File.dat/npra_final_chapter6.pdf



The investigator, Dr Aaron Wernham, used a qualitative HIA methodology, involving a combination of stakeholder input, literature review, and qualitative analysis, through which potential health effects were identified. The possible health outcomes identified were:

- Diabetes, high blood pressure, and related complications such as heart disease and strokes;
- Exacerbation of chronic lung disease, with potentially increased mortality;
- Cancer, endocrine disorders, and developmental delay if contaminants enter the food chain;
- Hunger and food insecurity;
- Domestic violence;
- Suicide;
- Drug and alcohol abuse;
- Anxiety and stress;
- Accidental deaths; and
- Infectious diseases such as HIV.

There were some potential benefits, including funding for infrastructure and health care; increased employment and income; and continued funding of existing infrastructure. Based on these findings, a series of public health mitigation measures were recommended.

Was the HIA useful in the North Slope?



http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/northeast_npr-a_final.html EIS/HIA

Wernham, A. Inupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated HIA/EIS for Proposed Oil Development on Alaskas North Slope. EcoHealth 4:500-513 (2007).

The author of the North Slope HIA was
Aaron Wernham, M.D., M.S.

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e: awernham@pewtrusts.org
www.healthimpactproject.org





Source: <http://passaicnews.wordpress.com/>

HIA REFERENCES

- http://www.hiaconnect.edu.au/files/HIA_International_Best_Practice_Principles.pdf
- <http://www.iaia.org/>
- Quigley, R., L. den Broeder, P. Furu, A. Bond, B. Cave and R. Bos 2006 *Health Impact Assessment International Best Practice Principles. Special Publication Series No. 5. Fargo, USA: International Association for Impact Assessment.*
- http://www.euro.who.int/_data/assets/pdf_file/0003/98283/E90794.pdf
- http://www.healthimpactproject.org/resources#presentations_webinars
- <http://www.cdc.gov/healthyplaces/hia.htm>
- [Health Impact Assessment: Integrating Health into the NEPA Process, January 2011](#) Author: Aaron Wernham, M.D., M.S.
Presented to: Transportation Resources Board, January 2011
- <http://www.apha.org/NR/rdonlyres/171AF5CD-070B-4F7C-A0CD-0CA3A3FB93DC/0/HIABenefitHlth.pdf> Health in All Policies, from the APHA
- <http://www.ph.ucla.edu/hs/health-impact/>
- <http://www.who.int/hia/en/>
- <http://www.naccho.org/topics/environmental/landuseplanning/HIAresources.cfm>
- http://www.apho.org.uk/default.aspx?QN=P_HIA
- http://www.dh.gov.uk/en/Publicationsandstatistics/Legislation/Healthassessment/DH_4093617
- http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_120110.pdf

ADDITIONAL REFERENCES (some citations are on the slides)

- Health effects http://www.damascuscitizens.org/Teitelbaum-Report_R1.pdf and <http://www.ccag.org.au/images/stories/pdfs/literature%20review%20witter%20et%20al%202008.pdf> and http://63.134.196.109/documents/10sep28_Otsego2000EPACommentsFINAL.pdf
- Water contamination http://www.edf.org/documents/9235_Barnett_Shale_Report.pdf and <http://www.nytimes.com/2011/02/01/business/energy-environment/01gas.html?src=me&ref=business> and http://www.earthworksaction.org/NM_GW_Contamination.cfm and <http://www.vanityfair.com/business/features/2010/06/fracking-in-pennsylvania-201006> and <http://www.fractracker.org/2010/09/water-well-contamination-studies.html> and http://switchboard.nrdc.org/blogs/ama1/incidents_where_hydraulic_frac.html
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Thank you

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