EX#127

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November 1, 2024

Town of Ledyard

Planning and Zoning Commission

Subject: Potential Environmental Health Hazards to Radon and Mosquito Borne Disease from Quarrying Operations within Residential Areas and Workplaces on and around the Proposed Gales Ferry Intermodal LLC Industrial Site.

Dear Commissioner's,

I am writing to you as a Ledyard resident as an Environmental Health Specialist. I have thirty-eight years of professional experience and credentials in the fields of Public Health, Communicable Disease Control and prevention, Occupational Safety and Health, and Disease Ecology Vector Control. I served for ten years in the US Navy Hospital Corps as a Preventive Medicine Specialist where I worked throughout Africa, Europe and the Middle East. I studied topical disease control methodology at the Blair Research Institute in Harare, Zimbabwe. After the Persian Gulf War, I began my career in local public health working for ten years as Chief Sanitarian with the City of New London Health Department, then for five years with the Ledge Light Health District as their supervising Environmental Sanitarian. I went on to work for eleven years as a Compliance Safety and Health Officer with Connecticut Department of Labor OSHA Division. I am currently retired. I have degrees in Environmental Health Technology from Merrit College, Oakland CA, and a BS in Business Administration from the University of Connecticut.

I have reviewed pertinent aspects of the site plan proposals that are relevant to this discussion. I have made a hazard assessment taking into consideration the hazards, the proximity of the population at risk to these hazards, the frequency of these exposures and some legal aspects.

Human exposures to Radon progenies and potential for the mosquito borne diseases of Eastern Equine Encephalitis (EEE) and West Nile Virus (WNV) will most likely be created.

Issues of Radon:

Radon is an invisible, odorless, and colorless gas that is emitted to the earth's surface as a result of the breakdown of uranium beneath the Earth's crust. Naturally occurring Radon is normally attenuated by natural encapsulation with soils and glacial till deposits. It is normal and not considered a hazard to humans unless or until encapsulations are penetrated, excavated, or removed, or when contaminated well water is aerated and aerosolized by water taps and shower heads in a home.

Considerable research related to radon exposures involves homes and indoor environments where gas emissions become trapped and concentrated. The gas becomes a hazard when the radioactive radon isotope attaches to airborne organic and mineral dust particulates which are inhaled and become lodged in inner lung tissues. These particles are called **radon progenies** and are known to cause lung cancer.

Radon is also released from the earth by seismic activity. The blasting, fracturing, and drilling of geologic rock at this site will enhance this release from the very beginning. The seismic vibrations from blasting can alter the geologic stasis of fissures in underlying bedrock and will very most likely alter the status of drilled water supply wells by disturbing the preexisting naturally occurring fissures where radon infiltrates the aquafer.

The phases to this proposed project will permanently alter the geology of the area. Gales Ferry has as large ledge rock outcrop along the Thames River. The Indoor Radon Potential Map of Connecticut reflects this geology in red as a high radon area. Sources indicate that Ledyard has recorded remarkably higher radon emissions than other areas of Connecticut.

The blasting and removal of the top soil layer's and quarrying geologic rock from Decatur Hill is proposed to last up to ten years. As compared to naturally occurring radon, the radon release by exposing the geology down through ledge and bedrock will be increased in an order of magnitude and will continue to discharge forever.

This will not be "Naturally Occurring Radon." This will be an anthropogenic anomaly releasing concentrations of radon into, onto, and around a residential environment. The Indoor Radon Potential Map of Connecticut already indicates that the sample of homes tested in this area scored remarkably high in radon potential in indoor air and well water.

The geologist's assurances to you on the public record that Radon discharges from this site will harmlessly rise off into the atmosphere is incorrect. Statements by representatives of Cashman Dredging & Marine reported in The Day paper are that "They take seriously their obligation to ensure health and safety of both their workers and the local community." (See "The Day" paper, January 4, 2024, page A1, A5.) They stated further that "Material really shouldn't largely get airborne." This provides no comfort or assurance for the public's health and wellbeing. It is a veiled admission confirming that fugitive mineral dusts, **potentially laden with radon isotopes,** can leave the site impacting persons and adjacent properties.

Considering the population density and well documented geologic radon potential of this area, this is not a suitable area for rock quarrying of this size and nature.

There are public health experts who may consult on this matter however, their knowledge, experience, and authority addresses health education, and awareness. Health authorities usually respond to concerns after discovery in indoor environments where testing indicates the EPA action level of 4 picocuries (pCi/l) or higher per liter of air, or 5000 picocuries or higher per liter of water are indicated in a home, a school or other occupied buildings.

The character and behavior of such releases in the indoor environment has been studied in mining and quarrying operations worldwide and there are clear links to lung cancers. Other than OSHA and the Mining Safety and Health Administration (MSHA), which protect employees, there are no laws that mandate radon mitigation, management or control. Banks, lenders, realtors, and insurance organizations may have some authority to mandate controls with home loans and new construction.

It is said that land will rise to its highest form of use. However, land ownership and responsibility can transfer, industrial enterprises can fail, projects and land can be abandoned. There is no guarantee that harm will not result from this enterprise.

Relevant to public health and wellbeing, written language in a zoning regulation creating a conflicted interpretation between what is quarrying and what is an allowable excavation are pointless arguments.

The Commission should consult with the Connecticut State Department of Public Health- Radon Program, and with the State of Connecticut Geologist. She has has oversight for Connecticut quarries and mines, or other third party geologists to evaluate deleterious outcomes that are most likely to occur during this development and over the years thereafter.

References:

1. State of Connecticut: Indoor Radon Potential Map of Connecticut.
2. Connecticut DEEP Bureau of Air Management.
3. State of Connecticut Department of Public Health (DPH): Radon Program, and radon testing in schools.
4. US EPA Radon Map of Connecticut.
5. National Institute of Health (NIH), National Library of Medicine, Toxicological Profile for Radon.
6. Other research and publications on Radon during mining, surface mining and quarrying.
7. US EPA, Air Toxics Website: Radionuclides including Radon.
8. US Department of Justice: Radiation Exposure Compensation Program.
9. Occupational Safety and Health Administration (OSHA) Radon Permissible Exposure Limits.

Issues of Mosquito Ecology and Mosquito Borne Disease in Connecticut:

Mosquitos are responsible for transmitting viruses to humans in Connecticut. The viruses of importance currently are Eastern Equine Encephalitis (EEE) and West Nile Virus (WNV). WNV became established in Connecticut in 1996.

Active surveillance of mosquitoes in the state indicate increases with population densities, prolonged breeding seasons, and infections. Climate change anomalies are impacting mosquito ecology in Connecticut as well as worldwide. New and emerging species are being reported, which are capable of transmitting a number of other diseases, not currently in our area, including but not limited to, Western Equine Encephalitis (WEE), Rift Velley Fever (RVF), Zika Virus and Dengue Virus. Dengue Virus is now a serious public health problem in France and other Mediterranean countries and it is speculated that it may become a new and emerging infection in places within the US. WEE is established in Connecticut within the *Culisita melanura* mosquito. As of yet there have been no human cases reported, but C. Melaura is a bridge vector for enchephalitide viruses.

The problem with this site development is the creation of breeding ecology and habitat where it previously does not exist. Mosquito species have specific types of breeding habitat. They breed in stagnant and polluted water, salt marshes, and tree holes, vegetated perimeters around water bodies, stump holes, swamps and artificial containers such as stagnated swimming pools, boat hulls. Roof gutters, bird baths, and automobile tires.

The quarrying plan at this site indicate creation of artificial surface water bodies in the form of six large water treatment and retention ponds. They are to size of recreational and commercial swimming pools which will remain during proposed post quarrying land use activities. These water bodies will become stagnated ponds with perimeter vegetation creating mosquito breeding habitat.

There will be other elemental sources of water impacting hydrology on this site. The multiple rock step structures of the tiered walls to this quarry, as they are being constructed, will create innumerable rock pockets which will hold water from rain, snow, ice melt, and the ground water leaching through the quarried walls will support mosquito breeding mediums.

Other than summer solstice periods, the north facing walls of this terraced bank will provide perpetual shade, which will enhance water retention by reduced evaporation. The terraces surfaces will remain wet for prolonged periods of time.

With this in mind it is critical to note the breeding behavior of some species of mosquitoes. Particularly the ***Aedes*** species and the *Ochlerotatus* species, which are vicious human biters and disease vectors. These species evolved with an instinct to identify a vessel or container capable of holding water or areas subject to intermittent flooding. They will deposit their eggs within or on the sides of these containments and continue to do so for days, weeks or months until water fills them allowing the eggs to hatch. This can cause massive broods of mosquitoes to emerge up to four times a year.

Because mosquitos are blood feeding parasites they are attracted to the carbon dioxide blooms from birds, other mammals, and humans by our exhaled breath and the lactic acid from our bodies. The population living in the area will be well within the flight range of questing mosquitoes emerging off this site.

These man made water containments will permanently alter the mosquito ecology and will expose the surrounding population to a plague of nuisance biting mosquitoes and potential disease vectors. Considering the known reproducible science and biology of mosquitoes, there is very little doubt that this will not occur. The proposed plan makes no mention of the mosquito ecology and control measures that must be considered with such land altering activities.

Please note Section 19-13-B1 of the Connecticut Public Health Code – "Conditions specifically declared to constitute public nuisances," sub paragraph (g), which reads, "Stagnant water likely to afford breeding places for mosquitoes within a residential district or within one thousand feet therefrom." **The bordering town of Montville will be within five hundred feet of this potential public health nuisance.**

The commission should consult with the Connecticut Agricultural Experimentation station (CAES) and/or other third party Medical Entomologists on this matter.

The commission should consult with the ledge Light Health District as to how it would respond to the creation of such nuisance.

References:

1. Identification Guide to the Mosquitoes of Connecticut (www.caes.state.ct.us).
2. CAES Mosquito Control Program.
3. Research and publications of the CASE Center for Excellence in Vector Borne Disease.
4. The current edition of: Control of Communicable Disease Manual (CCDM): Arthropod-Borne Viral Diseases section. An Official Report of the American Public Health Association.

Sincerely and respectfully,

Brian D. Sauvageau

Brian D. Sauvageau, RS

Explanation of the Map

[numbered references listed on the back]
[all reported averages are geometric means]

Radon is a radioactive gas found naturally in the environment as a decay product of uranium. Radon may contribute to an increased risk of lung cancer, especially in smokers [1;2]. The U.S. Environmental Protection Agency (EPA) has an action guideline of 4 picocuries of radon per liter of air (pCi/l) [1]. Above 4 pCi/l, EPA recommends action to reduce radon levels. Primary radon sources to the home include the surrounding soil and sediment, near-surface bedrock geology, and bedrock well water.

Appropriate Use and Limitations of the Map

This map may be used for focusing interest and targeting limited resources toward areas where they will have the most impact. This map has been developed using radon measurements in combination with geological and geophysical factors. Further investigations using additional radon measurements may alter radon potential rating areas. This map is for public education, and is a statewide planning tool for health officials and environmental professionals. This map is the best available tool for evaluating radon potential statewide. The map should not be used for site specific evaluations or real estate transactions. Determination of radon levels at any particular site requires radon testing. Do-it-yourself radon test kits are available at many home stores [$10-$50]. A list of trained professionals offering radon testing and mitigation services is available from the Department of Public Health (860) 509-7367.

Determination of Radon Potential Ratings

Area radon potentials are from a computerized spatial analysis of bedrock geology, surficial materials, and surface radioactivity mapping, with indoor air and bedrock well water radon data. The radon data includes 4721 homes and 958 bedrock wells tested for radon statewide between the years 1985-1995. The testing was conducted by the CT Department of Environmental Protection, CT Department of Public Health, U.S. Geological Survey, University of Connecticut, and Stamford Health Department [3; 4; 5; 6; 7; 8; 9; 10]. Radon measurements have been correlated with geological and geophysical factors enabling the mapping of radon potential. Digital resource maps were scored separately for radon potential (see table below), and compared to indoor air analyses to determine the usefulness of each resource map for the prediction of radon. The radon potential map is a summation of radon scores developed from these earlier analyses.

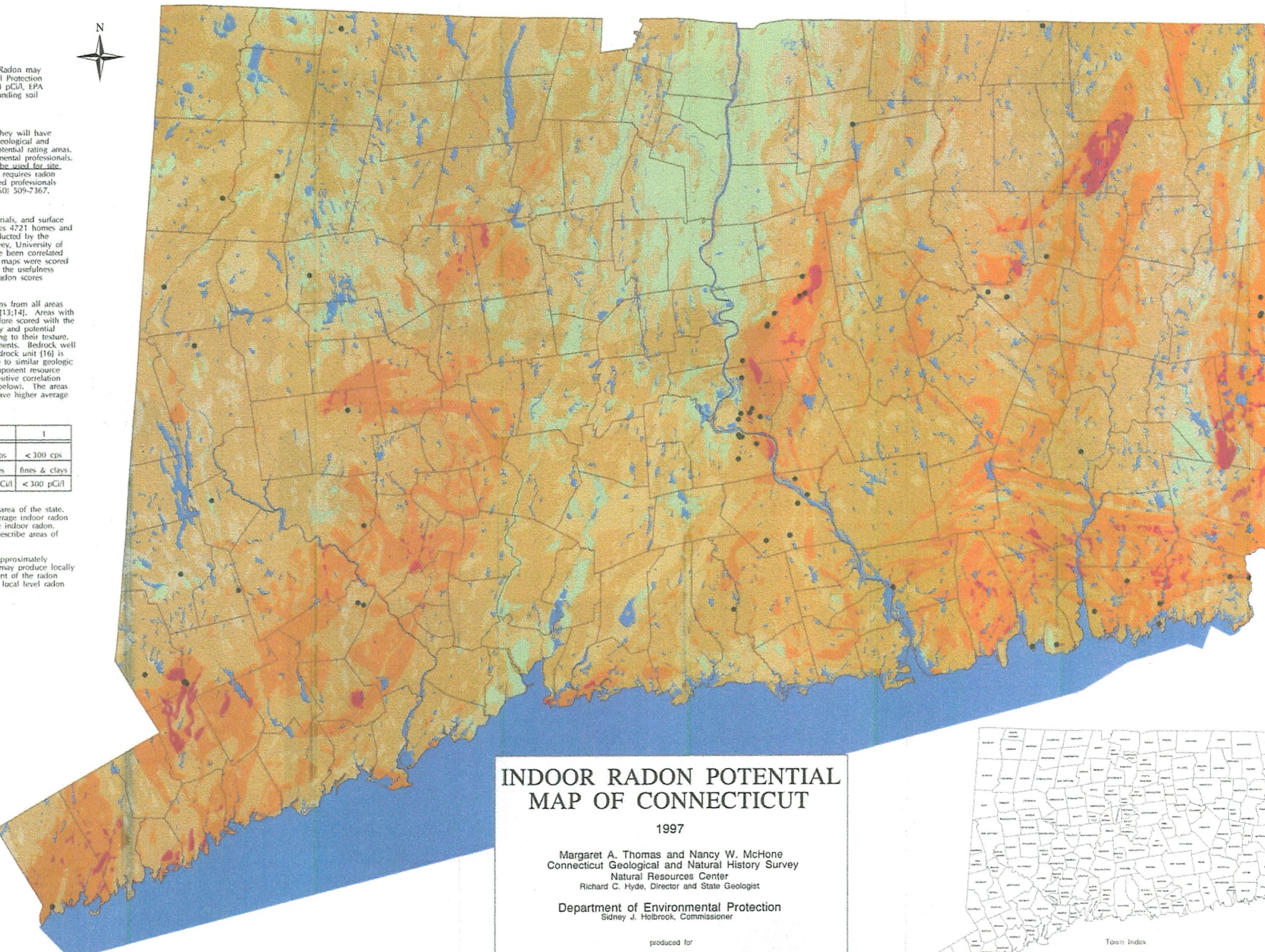
Surface radioactivity measurements [11;12] provide summary information for total gamma emissions from all areas of the state. There is a direct correlation between surface radioactivity and average indoor radon [13;14]. Areas with the highest surface radioactivity correlate with areas of highest average indoor radon and are therefore scored with the highest radon potential. Surficial materials units [15] are used as a measure of surface permeability and potential radon transport to the surface. As such, surficial materials units are assigned radon scores according to their texture. Areas of coarse-grained sediments are assigned higher radon scores than areas of fine-grained sediments. Bedrock well water radon values are used as a measure of the potential radon source in the bedrock. Each bedrock unit [16] is assigned a radon score based on the average radon in the well water of that unit, or by reference to similar geologic units [16;17;18]. The scoring strategies have been tested by comparing radon scores for each component resource map with indoor air radon data [see back of map]. Each of these scoring strategies provides a positive correlation between average indoor radon and the assigned radon scores of individual mapping components (below). The areas of more permeable sediments, higher bedrock well water radon, and higher surface radioactivity have higher average indoor radon.

Scores for Component Resource Maps

Radon Potential Score	5	4	3	2	1
Surface Radiation (counts per second gamma)	≥ 900 cps	900-700 cps	700-500 cps	500-300 cps	< 300 cps
Surficial Materials	———	gravel & coarse sand	mixed sands	mixed fines	fines & clays
Bedrock Well Water	≥ 10,000 pCi/l	9,999-5,000 pCi/l	4,999-3,000 pCi/l	2,999-300 pCi/l	< 300 pCi/l

The combined scores of component resource maps create a total radon potential score for each area of the state. These scores range from totals of 4 to 13. Frequency analyses show a progressive increase in average indoor radon with total radon potential score. The total scores are grouped into 4 categories by similar average indoor radon. These categories are shown on the map as radon potential ratings. These radon potential ratings describe areas of statistically different indoor radon levels.

Sites of naturally occurring radioactive minerals referenced in the geologic literature [19;20] are approximately located on this map where possible. These sites include an assemblage of various minerals which may produce locally high radon. These sites are included on the map for reference and are not part of the development of the radon potential ratings. These mineral locations may be useful tools in the development of regional and local level radon potential evaluations.



Radon Potential Rating*

The radon potential rating indicates the percentage of tested homes in these areas with basement air radon greater than or equal to 4.0 pCi/l

Low	6%
Low - Moderate	16%
Moderate	22%
Moderate - High	33%
High	48%

Water or Wetland

Towns

• Naturally Occurring Radioactive Minerals
Sites may produce locally high radon levels

NOTE: Because the presence of radon is very site specific, the Department of Public Health recommends that homes be tested regardless of whether the location is in a low or high radon potential area.

* Individual Home Indoor Air Radon Values May Differ

The area radon potential ratings are developed using statistical analyses which provide information on the likelihood of elevated radon in homes located within particular types of geologic situations. Within area radon potential ratings there will be both low radon homes and high radon homes. Basement [or ground level] fall and winter air radon tests are used in the analyses in order to provide 'worst case' radon potential estimates. Homes with elevated radon in the basement are more likely to have elevated radon in an upstairs living area. An exception to this is in a situation where high radon bedrock well water is a dominant contributor to the indoor air radon of the home. Typically the radon level in the first floor of a home is lower than the basement radon value. Homes served by public water supplies where the water is derived from stratified drift aquifers or held in reservoirs typically have a lower water radon potential [4;21].

Acknowledgements

This analysis could not be possible without the work of those who produced the digital data used in the development of this map: these people are Larry Colbert Jr., Paul Davis, Mary DiGiacomo-Cohen, Jeff Hollis, Kurt Kress, Bill Penn, John Seifert, and Maria van der Werff. Cindy Barber provided technical expertise in the ways of GIS. The University of Connecticut Center for Environmental Health provided a pilot grant to help digitize surficial materials data and fund student labor for fieldwork. Helpful consultations were provided by many, including Sigrid Asher Bolynder, Gene Boudette, Denis Healy, Richard Hyde, Kip Kolesinskas, Sid Quarrier, Roy Shook, Janet Stone, and Zoltan Szabo. Locational verification of indoor air analyses was provided by members of the Yale Radon Study. The Connecticut Department of Public Health supported and promoted this project for several years through administration of the U.S. EPA, State Indoor Radon Grant Program for Connecticut.

INDOOR RADON POTENTIAL MAP OF CONNECTICUT

1997

Margaret A. Thomas and Nancy W. McHone
Connecticut Geological and Natural History Survey
Natural Resources Center
Richard C. Hyde, Director and State Geologist

Department of Environmental Protection
Sidney J. Holbrook, Commissioner

produced for

Department of Public Health
Stephen A. Harriman, Commissioner

Scale 1 : 250,000

Town Index

Developed using U.S. EPA State Indoor Radon Grant Program and State of Connecticut funds. This map is available from the Connecticut Department of Public Health, Indoor Air Program, 410 Capitol Avenue, Hartford, CT 06134-0308, (860) 509-7367, or the Connecticut Department of Environmental Protection, Natural Resources Center, 79 Elm Street, Hartford, CT 06106-5127, (860) 424-3555.

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References and Published Data Sources

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[2] U.S. Environmental Protection Agency, 1994, Report to the United States Congress on radon in drinking water - multimedia risk and cost assessment of radon: Washington, D.C., [EPA 811-R-94-001] [variously paged].

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[15] Stone, J.R., Schafer, J.P., London, E.H., and Thompson, W.B., 1992, Surficial Materials Map of Connecticut: U.S. Geological Survey Special Map, 2 sheets, scale 1:125,000 [digital data from 1:24,000 scale compilation available through CT Department of Environmental Protection].

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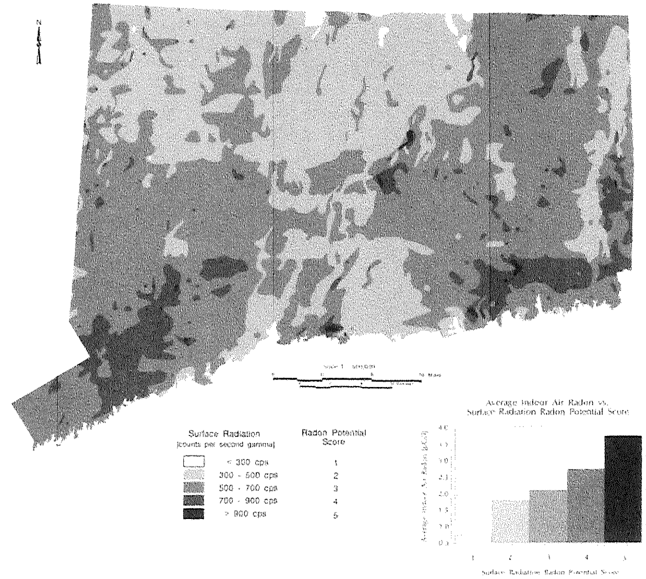
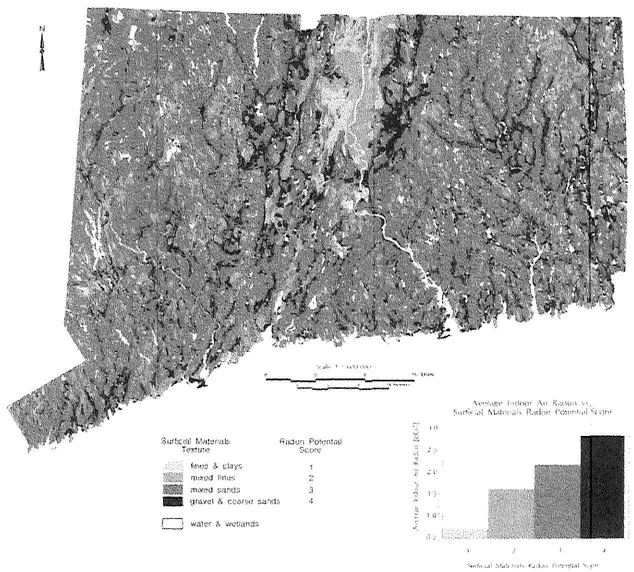
Radon Potential Scores and Comparison of Scores with Average Indoor Radon

[all reported averages are geometric means]

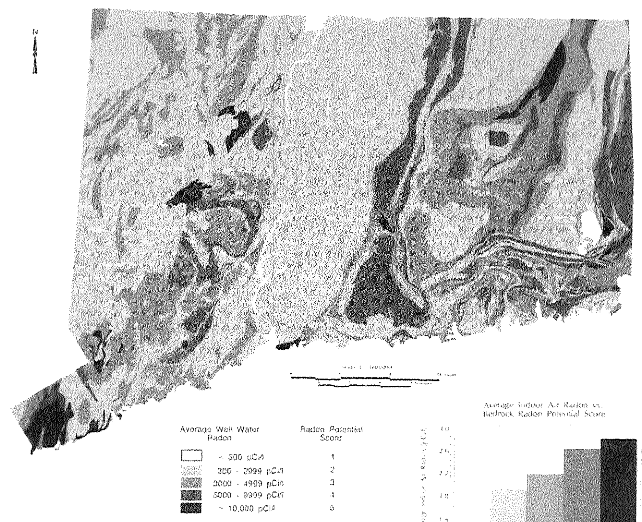
Surface Radiation Radon Potential Scores



Surficial Materials Radon Potential Scores

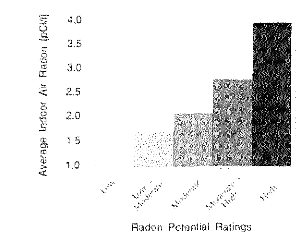


Bedrock Geology Radon Potential Scores



The overall statewide average bedrock well water radon for 938 wells is 3032 pCi/l. However, temporal variation of radon levels in well water has been found to be as much as 81% of the arithmetic mean. [10]

Indoor Radon Potential Map of Connecticut
Radon Potential Ratings vs. Average Indoor Air Radon



Radon potential ratings were developed from the summation of radon potential scores of component resource maps. The total scores were compared to average indoor radon and grouped according to similar radon levels. These groups comprise the radon potential ratings. Kruskal-Wallis ANOVA and Mann-Whitney Rank Sum numerical tests have shown the radon values within these rating areas to be statistically different from each other. Additionally, there is a progressive increase in the percentage of homes above the EPA action guideline of 4 pCi/l in the areas identified with higher radon potential ratings. This analysis therefore provides a meaningful tool for the statewide assessment of indoor radon potential.

Radon Potential Ratings	Average Indoor Radon (pCi/l)	Number of Homes Tested	Percent 4 pCi/l or Above
Low	1.33	214	5.6
Low-Moderate	1.73	768	16.3
Moderate	2.10	2640	21.8
Moderate-High	2.79	1026	33.0
High	3.96	65	47.7

The overall statewide basement air radon average for 4723 homes is 2.12 pCi/l.

Generalized soils mapping [22] and depth to the water table data [23] have been investigated as possible radon potential mapping tools, but have not been included in the scoring strategy because comparisons of soil transmissivity and water table depths with indoor air radon data do not yield discernable trends. Surficial materials thickness mapping [24] shows a significant decrease in radon values overlying sediment greater than 50 feet; however, this finding does not contribute to the radon potential mapping.

ARBOVIRUSES ISOLATED FROM MOSQUITOES IN CONNECTICUT

Mosquito Species	Arbovirus*							
	CV	EEE	FL	HJ	JC	TVT	WEE	WN
Aedes								
Aedes cinereus	X	X		X	X			X
Aedes vexans	X	X		X	X			X
Anopheles								
Anopheles punctipennis	X	X		X	X	X		X
Anopheles quadrimaculatus	X	X		X				X
Anopheles walkeri	X	X			X			X
Coquillettidia								
Coquillettidia perturbans	X	X	X	X	X	X		X
Culex								
Culex pipiens		X	X	X				X
Culex restuans		X	X	X	X			X
Culex salinarius		X	X	X				X
Culex territans		X						
Culiseta								
Culiseta melanura	X	X	X	X			X	X
Culiseta morsitans		X		X	X			
Ochlerotatus								
Ochlerotatus abserratus					X			
Ochlerotatus aurifer					X			
Ochlerotatus canadensis	X	X		X	X			X
Ochlerotatus cantator	X	X		X	X			X
Ochlerotatus communis					X			
Ochlerotatus excrucians					X			
Ochlerotatus provocans					X			
Ochlerotatus sollicitans	X	X			X			X
Ochlerotatus sticticus	X	X			X	X		X
Ochlerotatus stimulans				X	X			
Ochlerotatus taeniorhynchus	X	X			X			X
Ochlerotatus triseriatus	X	X		X	X			X
Ochlerotatus trivittatus	X	X			X	X		X
Psorophora								
Psorophora ferox	X	X		X	X	X		X
Uranotaenia								
Uranotaenia sapphirina		X		X				X

* CV-Cache Valley, EEE-Eastern equine encephalitis, FL-Flanders, HJ-Highlands J, JC-Jamestown Canyon, TVT-Trivittatus, WEE-Western equine encephalitis, WN-West Nile

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