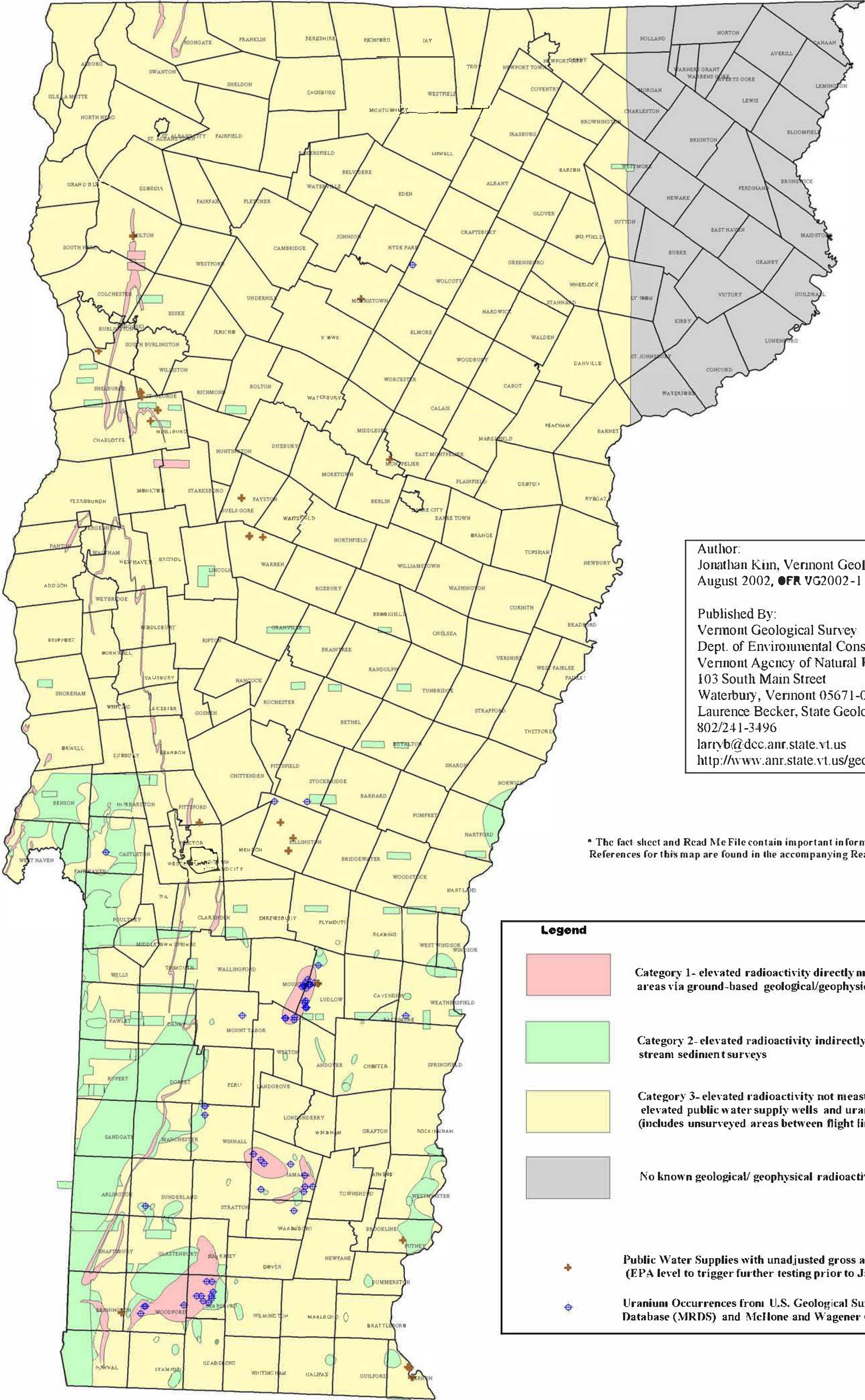


Compilation and Assessment of Radioactivity Data in Vermont

Plate I of IX (plus fact sheet and Read Me File\*)



Author:  
Jonathan Kim, Vermont Geological Survey,  
August 2002, **●FR** VG2002-1

Published By:  
Vermont Geological Survey  
Dept. of Environmental Conservation  
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<http://www.anr.state.vt.us/geology/vgshunpg.htm>

\* The fact sheet and Read Me File contain important information about this map.  
References for this map are found in the accompanying Read Me File

Legend

Category 1- elevated radioactivity directly measured in all or part of these areas via ground-based geological/geophysical studies

Category 2- elevated radioactivity indirectly measured via airborne or stream sediment surveys

Category 3- elevated radioactivity not measured in these areas other than elevated public water supply wells and uranium occurrences (includes unsurveyed areas between flight lines)

No known geological/ geophysical radioactivity survey data available

Public Water Supplies with unadjusted gross alpha >= 15 picocuries/ liter (EPA level to trigger further testing prior to January 2002)

Uranium Occurrences from U.S. Geological Survey Mineral Resources Database (MRDS) and McIlone and Wagener (1980) NURE Investigation

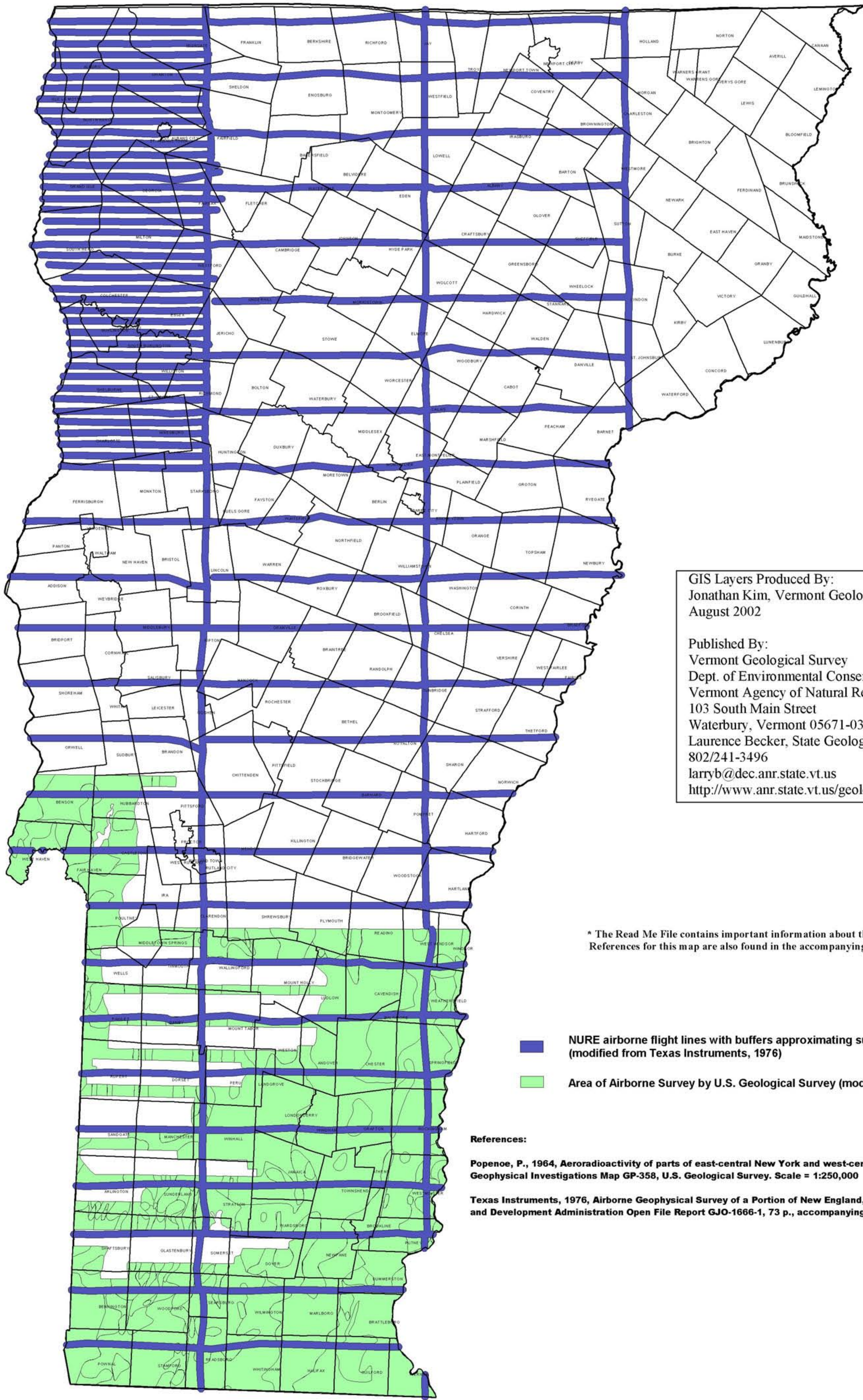
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

Although every effort has been made to faithfully portray the information from the surveys, the Vermont Agency of Natural Resources cannot vouch for the accuracy of the data on which the map(s) was based. No warranty as to the accuracy or the usefulness of the data on the map(s) is expressed or implied.

# Airborne Radioactivity Coverage of Vermont

Plate II of IX (plus Read Me File\*)



GIS Layers Produced By:  
Jonathan Kim, Vermont Geological Survey,  
August 2002

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<http://www.anr.state.vt.us/geology/vgshmpg.htm>

\* The Read Me File contains important information about this map.  
References for this map are also found in the accompanying Read Me File

- NURE airborne flight lines with buffers approximating surveyed area (modified from Texas Instruments, 1976)
- Area of Airborne Survey by U.S. Geological Survey (modified from Popenoe, 1964)

**References:**

Popenoe, P., 1964, *Aeroradioactivity of parts of east-central New York and west-central New England*, Geophysical Investigations Map GP-358, U.S. Geological Survey. Scale = 1:250,000

Texas Instruments, 1976, *Airborne Geophysical Survey of a Portion of New England*, U.S. Energy Research and Development Administration Open File Report GJO-1666-1, 73 p., accompanying maps scale = 1:250,000.



0 70 Miles

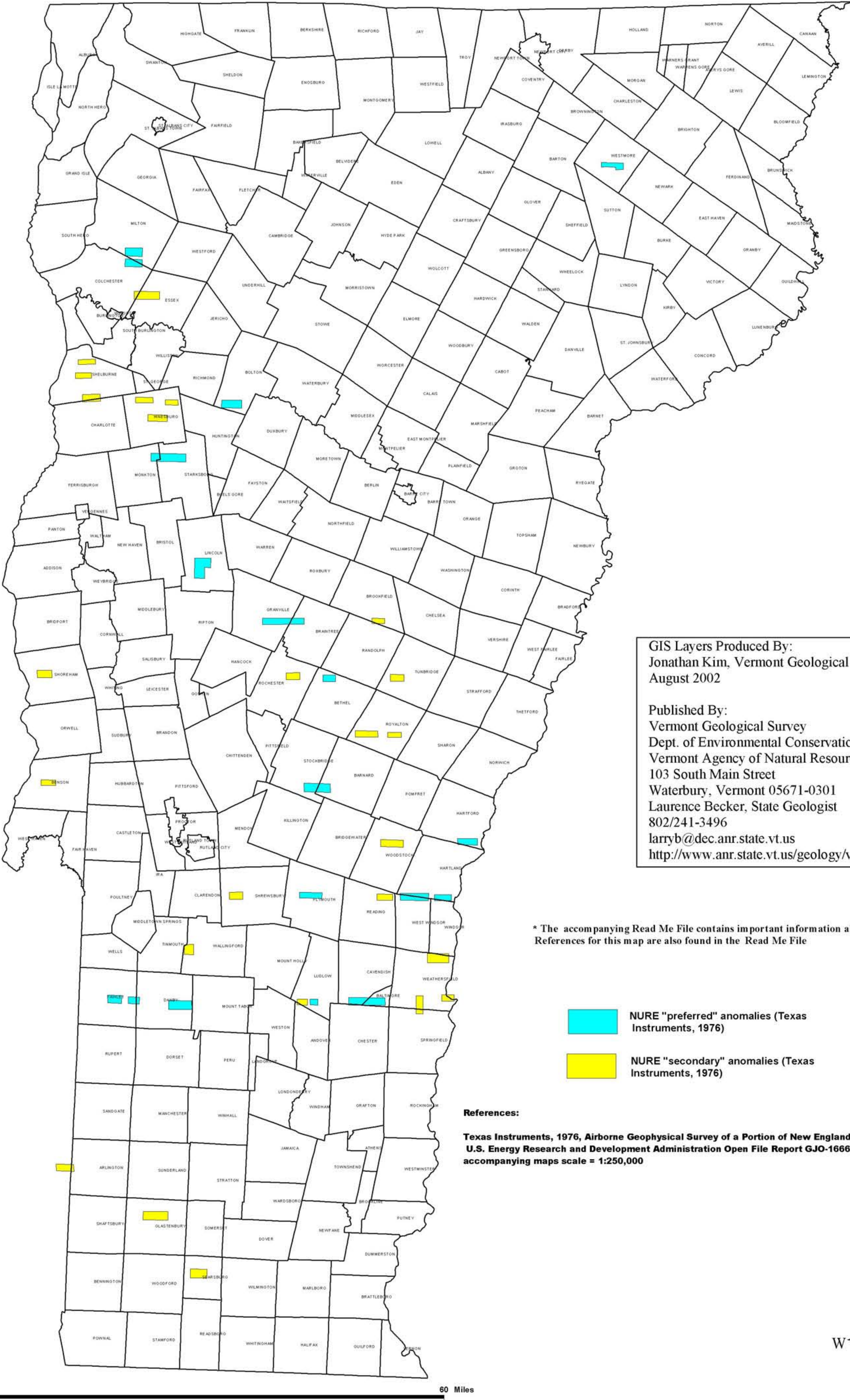
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

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NURE Aeroradiometric Anomalies

Plate III of IX (plus Read Me File\*)



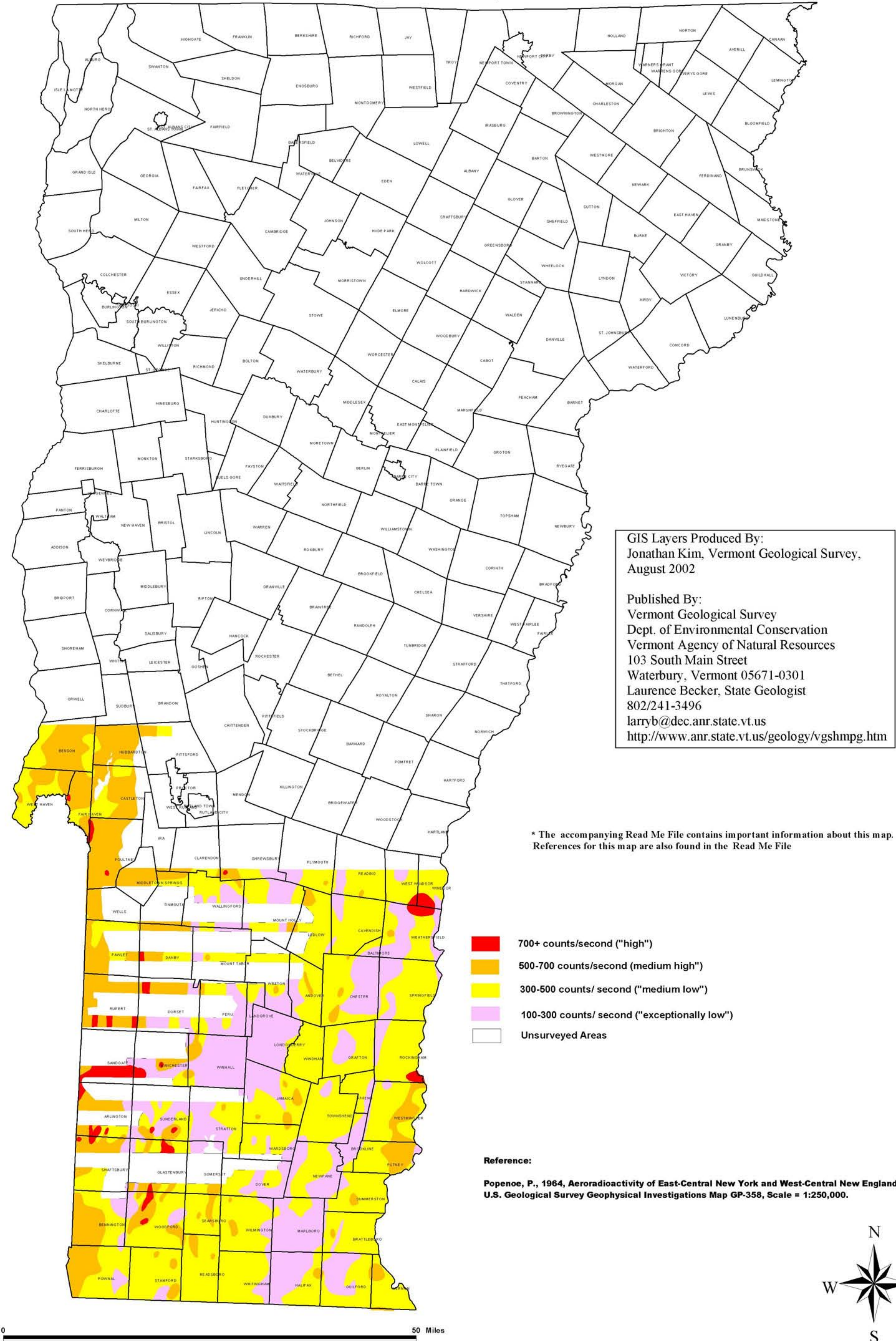
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

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Modified Aeroradiometric Map of Popenoe (1964), U.S.G.S. GP-358

Plate IV of IX (plus Read Me File\*)



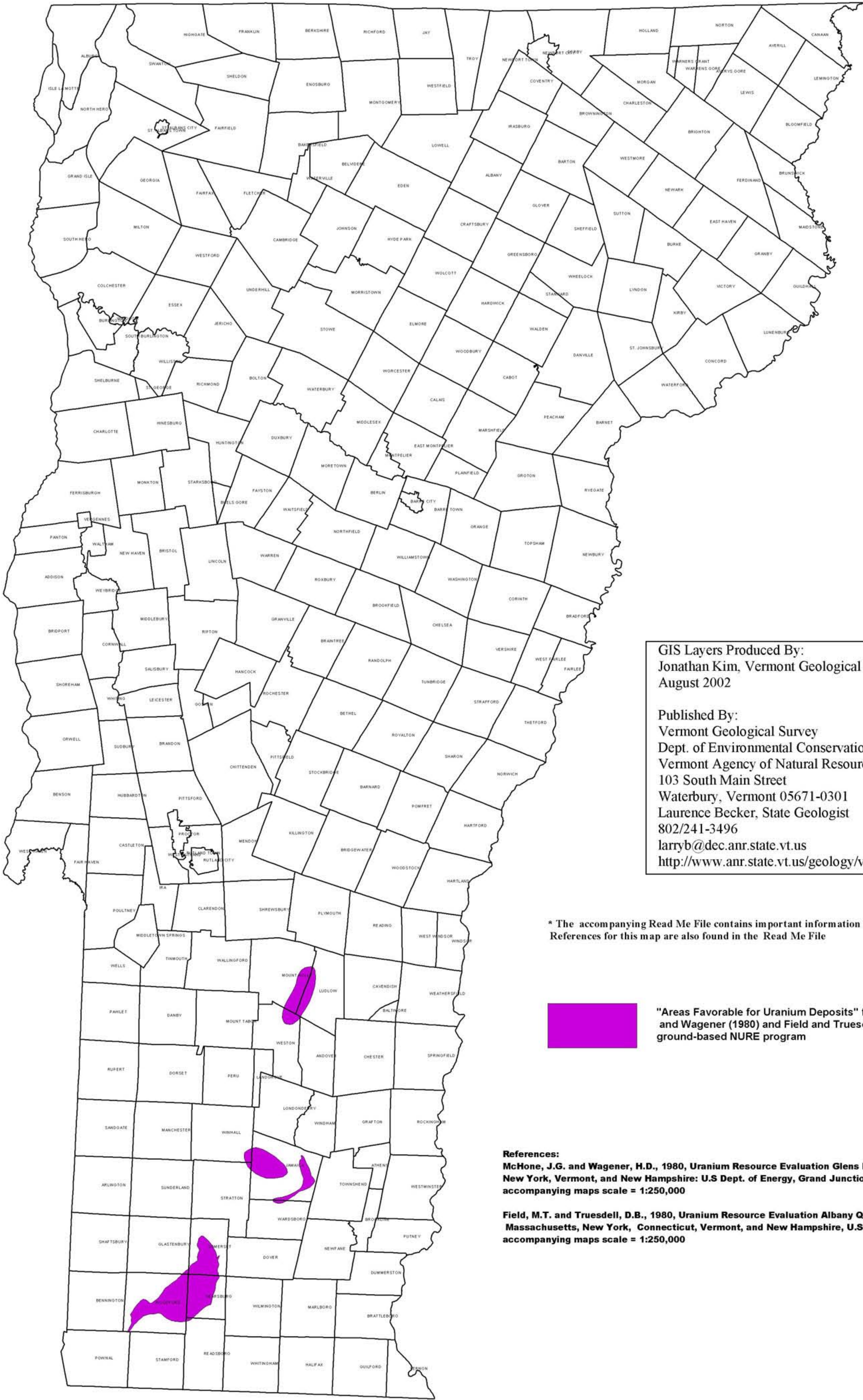
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

Although every effort has been made to faithfully portray the information from the surveys, the Vermont Agency of Natural Resources cannot vouch for the accuracy of the data on which the map(s) was based. No warranty as to the accuracy or the usefulness of the data on the map(s) is expressed or implied.

NURE Ground-Based Uranium Surveys

Plate V of IX (plus Read Me File\*)



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<http://www.anr.state.vt.us/geology/vgshmpg.htm>

\* The accompanying Read Me File contains important information about this map.  
References for this map are also found in the Read Me File

"Areas Favorable for Uranium Deposits" from McHone and Wagener (1980) and Field and Truesdell (1980) as part of ground-based NURE program

**References:**  
**McHone, J.G. and Wagener, H.D., 1980, Uranium Resource Evaluation Glens Falls Quadrangle New York, Vermont, and New Hampshire: U.S Dept. of Energy, Grand Junction Colorado, 40 p., accompanying maps scale = 1:250,000**  
**Field, M.T. and Truesdell, D.B., 1980, Uranium Resource Evaluation Albany Quadrangle Massachusetts, New York, Connecticut, Vermont, and New Hampshire, U.S. Dept. of Energy, 57 p., accompanying maps scale = 1:250,000**

The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthyvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

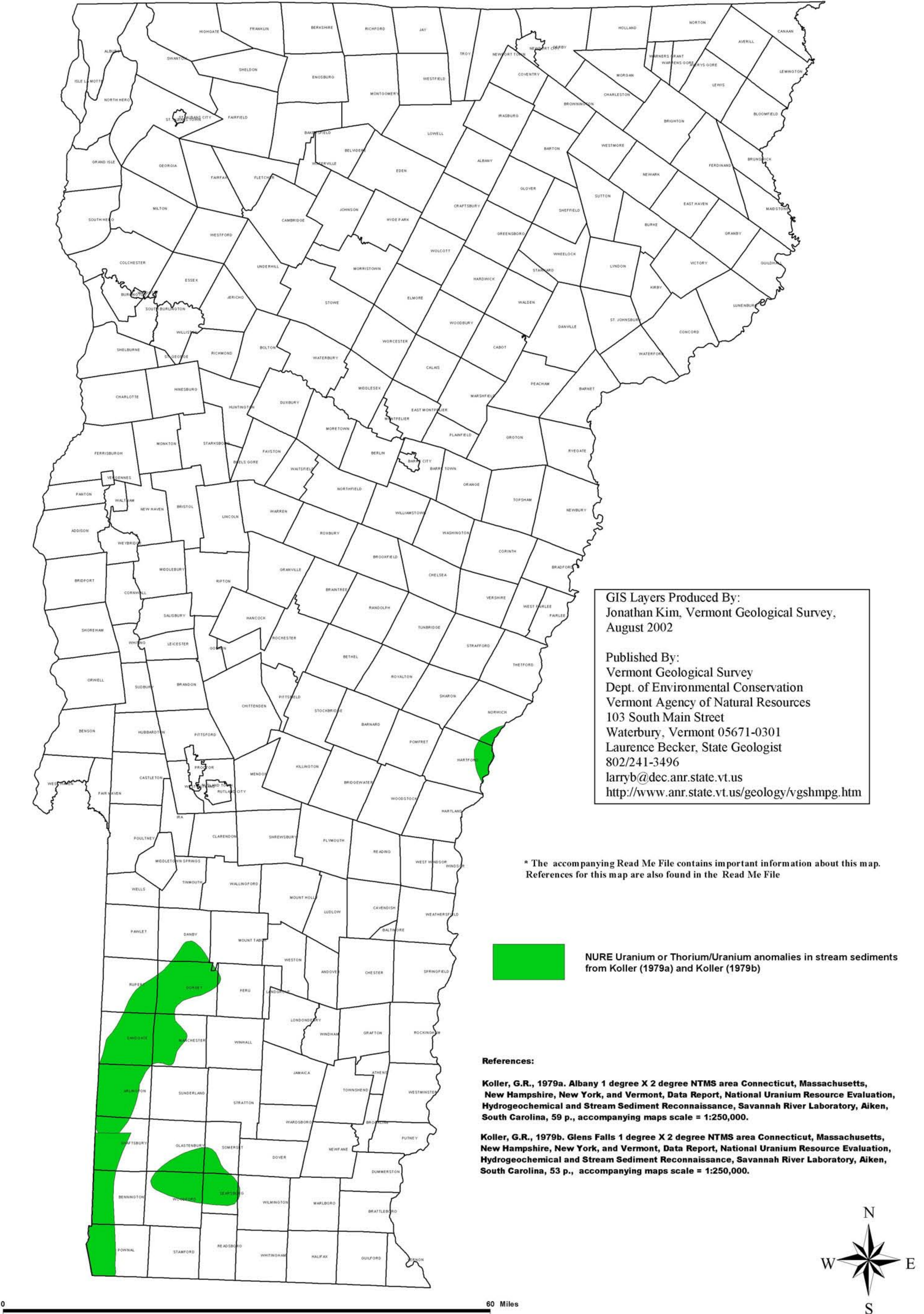
This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

Although every effort has been made to faithfully portray the information from the surveys, the Vermont Agency of Natural Resources cannot vouch for the accuracy of the data on which the map(s) was based. No warranty as to the accuracy or the usefulness of the data on the map(s) is expressed or implied.



# NURE Stream Sediment Data

Plate VI of IX (plus Read Me File\*)



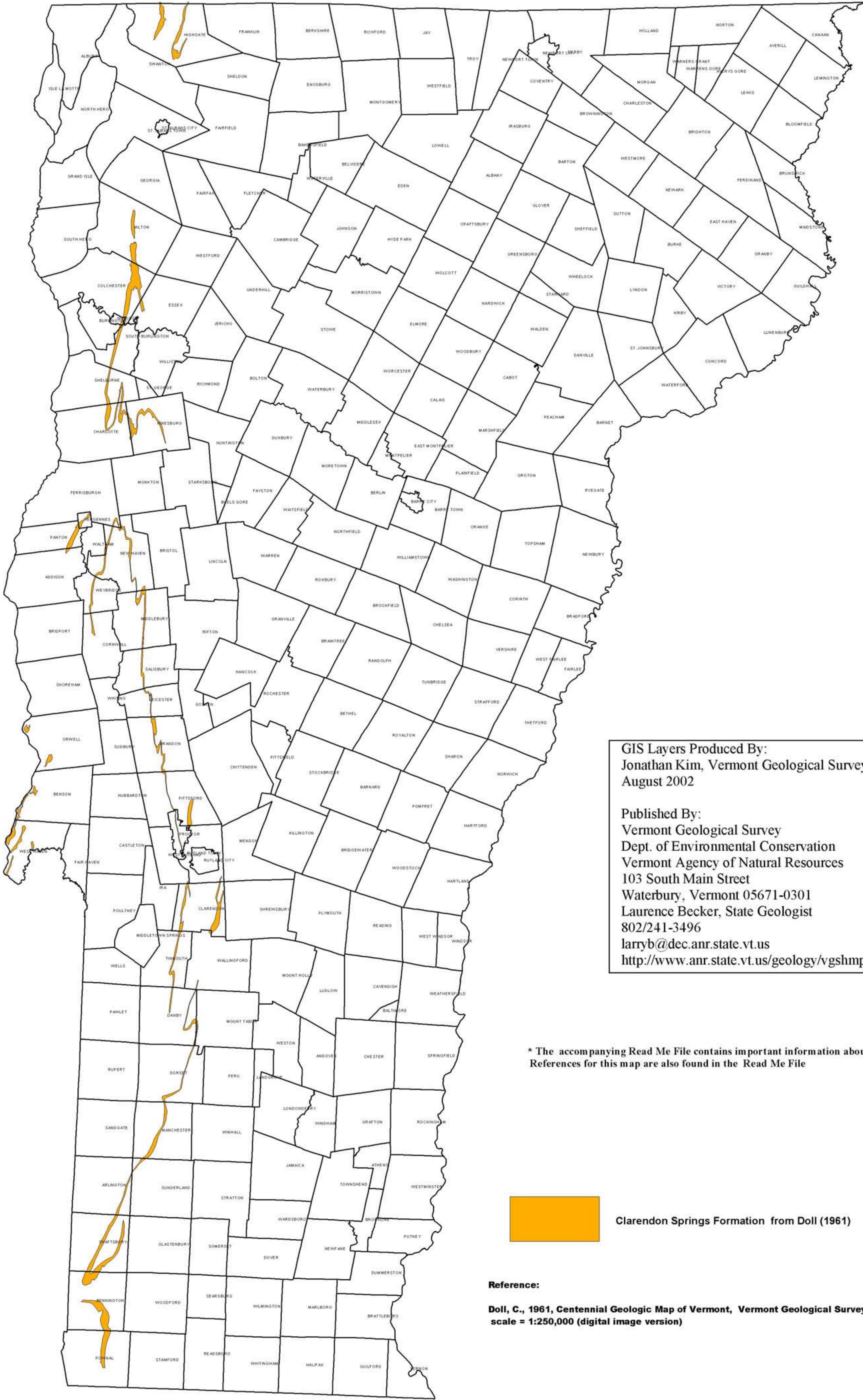
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthyvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

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Clarendon Springs Formation

Plate VII of IX (plus Read Me File\*)



GIS Layers Produced By:  
Jonathan Kim, Vermont Geological Survey,  
August 2002

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Vermont Geological Survey  
Dept. of Environmental Conservation  
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<http://www.anr.state.vt.us/geology/vgshmpg.htm>

\* The accompanying Read Me File contains important information about this map.  
References for this map are also found in the Read Me File



Clarendon Springs Formation from Doll (1961)

Reference:  
Doll, C., 1961, Centennial Geologic Map of Vermont, Vermont Geological Survey,  
scale = 1:250,000 (digital image version)

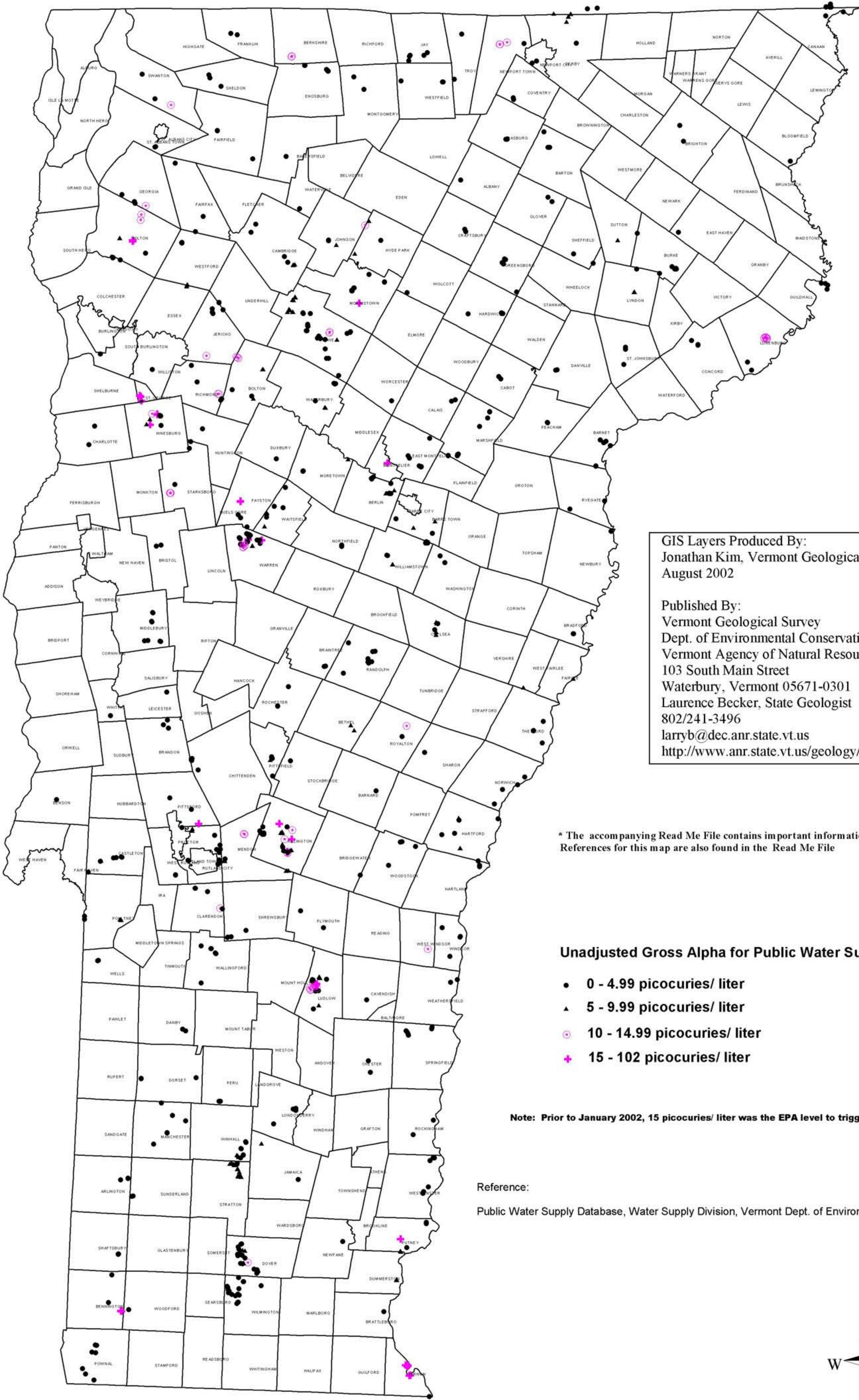
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

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Gross Alpha Values for Public Water Supplies in Vermont that Utilize Groundwater

Plate VIII of IX (plus Read Me File\*)



GIS Layers Produced By:  
Jonathan Kim, Vermont Geological Survey,  
August 2002

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Vermont Geological Survey  
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<http://www.anr.state.vt.us/geology/vgshmpg.htm>

\* The accompanying Read Me File contains important information about this map. References for this map are also found in the Read Me File

Unadjusted Gross Alpha for Public Water Supplies

- 0 - 4.99 picocuries/ liter
- ▲ 5 - 9.99 picocuries/ liter
- ⊕ 10 - 14.99 picocuries/ liter
- ⊕ 15 - 102 picocuries/ liter

Note: Prior to January 2002, 15 picocuries/ liter was the EPA level to trigger further testing

Reference:  
Public Water Supply Database, Water Supply Division, Vermont Dept. of Environmental Conservation

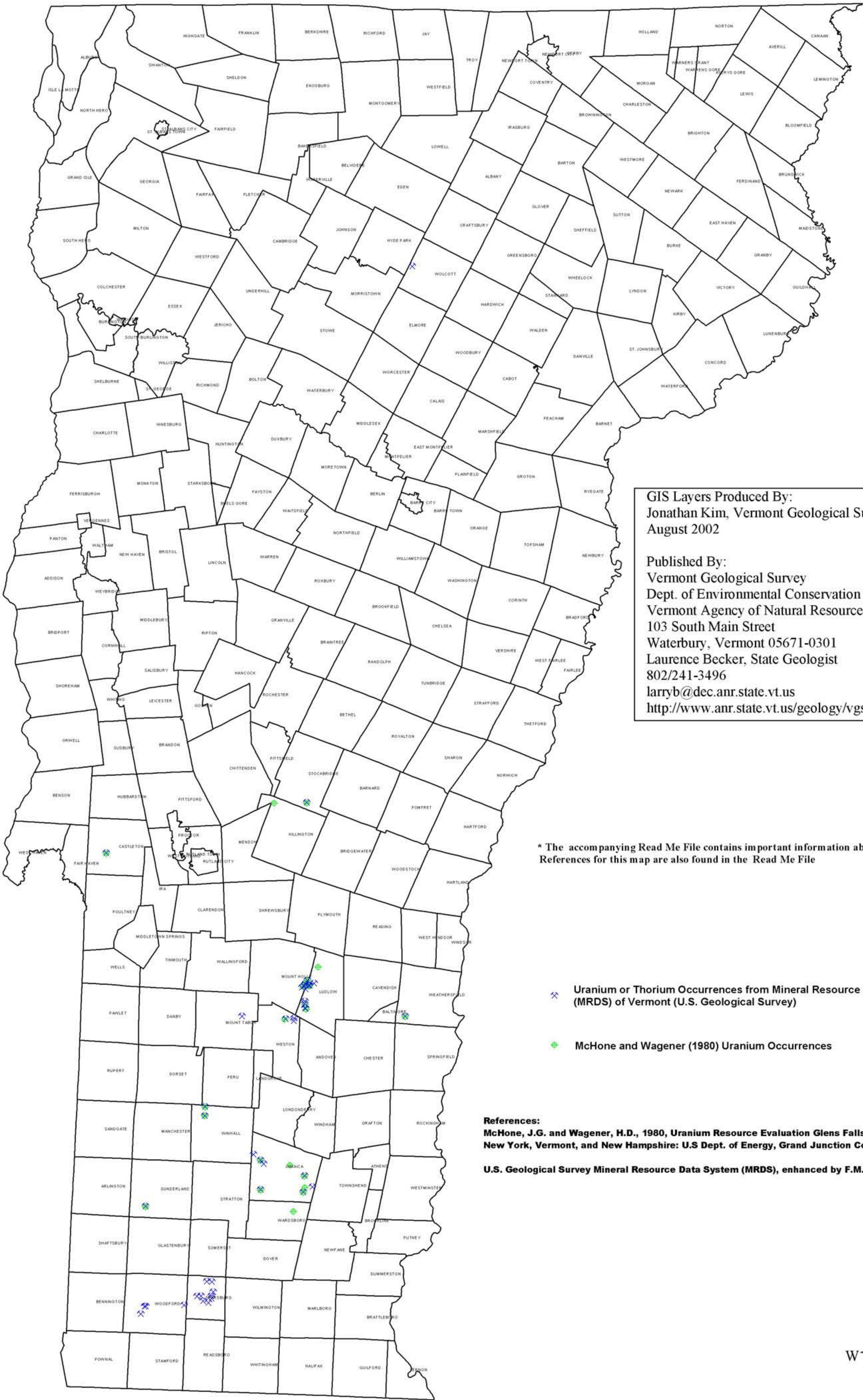
The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthyvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

Although every effort has been made to faithfully portray the information from the surveys, the Vermont Agency of Natural Resources cannot vouch for the accuracy of the data on which the map(s) was based. No warranty as to the accuracy or the usefulness of the data on the map(s) is expressed or implied.

# Uranium Occurrences in Vermont

Plate IX of IX (plus Read Me File\*)



GIS Layers Produced By:  
Jonathan Kim, Vermont Geological Survey,  
August 2002

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<http://www.anr.state.vt.us/geology/vgshmpg.htm>

\* The accompanying Read Me File contains important information about this map. References for this map are also found in the Read Me File

Uranium or Thorium Occurrences from Mineral Resource Data System (MRDS) of Vermont (U.S. Geological Survey)

McHone and Wagener (1980) Uranium Occurrences

**References:**  
**McHone, J.G. and Wagener, H.D., 1980, Uranium Resource Evaluation Glens Falls Quadrangle New York, Vermont, and New Hampshire: U.S. Dept. of Energy, Grand Junction Colorado, 40 p..**  
**U.S. Geological Survey Mineral Resource Data System (MRDS), enhanced by F.M. Beck (1998)**

The only way to determine with certainty whether groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their water for naturally-occurring alpha radiation every five years (<http://www.healthvermonters.info/hs/lab/waterusers.shtml>). This map(s) should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

This map (and the eight other maps in this series) displays geological and geophysical data compiled from surveys conducted at various times over several decades. The information used in preparing the map(s) represents the best data possessed by the Vermont Agency of Natural Resources at the time of production. The data is subject to revision at any time and the map user should contact the Vermont Agency of Natural Resources to determine whether there have been any changes in the data on which the map(s) was based.

Although every effort has been made to faithfully portray the information from the surveys, the Vermont Agency of Natural Resources cannot vouch for the accuracy of the data on which the map(s) was based. No warranty as to the accuracy or the usefulness of the data on the map(s) is expressed or implied.

Read me files for GIS data associated with Compilation and Assessment of Radioactivity Data in Vermont, 2002

Author: Jonathan Kim

Organization: Vermont Geological Survey

Date: August 2002

Coordinate system: NAD 83 Vermont Stateplane coordinates (Zone 5526) in meters

Disclaimer: This coverage was digitized from original 1:250,000 scale maps and data and, therefore, use at this scale is recommended. Accuracy may diminish when enlarged beyond this scale. The only way to determine with certainty if groundwater from a particular well has elevated radionuclide levels is to have the water tested by a certified lab. The Vermont Department of Health recommends that all private well owners test their wells for naturally-occurring alpha radiation every 5 years. This map should not be used as a replacement for detailed, site-specific studies by competent technical personnel.

**Plate I and Associated GIS Layers: Compilation and Assessment of Radioactivity Data in Vermont**

Required Files

Pws 15+ v2.dbf, Pws 15+ v2.shp, Pws 15+ v2.shx, Pws 15+ v2.sbn, Pws 15+ v2.sbx  
Townbound.dbf, Townbound.shp, Townbound.shx, Townbound.sbn, Townbound.sbx  
Mrds+mwushp.dbf, Mrds+mwushp.shp, Mrds+mwushp.shx  
Category 1v2.dbf, Category 1v2.shp, Category 1v2.shx  
5-20-02 Category 2.shp, 5-20-02 Category 2.shp, 5-20-02 Category 2.shp  
No Data.dbf, No Data.shp, No Data.shx,  
Category 3v3.dbf, Category 3v3.shp, Category 3v3.shx

**In order to reproduce this map in GIS format so that it corresponds exactly with the Vermont Geological Survey version, the order of layers from top to bottom must be as listed above.**

Description of Layers

Pws 15+ v2.\* files: This point coverage shows the locations of all wells in the public water supply database that have unadjusted gross alpha results greater than or equal to 15 picocuries/liter (EPA level to trigger further testing prior to January 2002). The pws 15+ v2.shp coverage was extracted in Arcview 3.2a from the pwsgwonly.shp file which gives the gross alpha results for all public water supplies in Vermont that utilize a groundwater source (surface water supplies were removed). The pwsgwonly.shp file was derived from a grossalpha.shp file that was produced by the Water Supply Division of Vermont Dept. of Environmental Conservation.

Mrds+mwushp.\* files: This point coverage is a combination of the U.S.G.S. Mineral Resource Data System (MRDS) list of uranium or thorium prospects/occurrences and the McHone and Wagener (1980) uranium occurrences from their ground-based National Uranium Resource Evaluation (NURE). The McHone and Wagener (1980) uranium occurrences compose a significant portion of the MRDS data set for uranium occurrences.

Category1v2.\* files This coverage represents as described on the *Compilation and Assessment of Radioactivity Data in Vermont* map legend "Category 1- elevated radioactivity directly measured in all or parts of these areas via ground-based geological/geophysical studies". Ground-based investigations in which direct measurements of elevated radioactivity or elevated abundances of radionuclides are made on the ground through gamma ray spectrometer surveys and geochemical analyses of rocks and groundwater are considered to be the most reliable form of data. This coverage was compiled from three different coverages which are:

NUREground.\* files "Areas Favorable for Uranium Deposits" as delineated by National Uranium Resource Evaluation (NURE) ground-based investigations of McHone and Wagener (1980) and Field and Truesdell (1980) in the southern half of Vermont. These NURE studies involved gamma ray spectrometer studies conducted by car and on foot as well as geochemical analyses of numerous rock samples containing uranium.

Cspolys.\* files This coverage of the Clarendon Springs Formation was digitized from the Doll (1961) Centennial Geologic Map of Vermont. Numerous studies have shown the Clarendon Springs Formation to have elevated radioactivity or radionuclide levels in the northern half of Vermont:

1. Highgate Springs area: Rio Tinto Canadian Exploration (1972)(described in Dorsey and Vanacek, 1983) and Dorsey and Vanacek (1983)
2. Milton and Colchester area: McKeown (1951), Vanacek and Dorsey (1983); Whitten (1988a and 1988b); Vermont Geological Survey/Vermont Dept. of Health (2000); Kim and Thompson (2002).
3. Middlebury area: Middlebury College Environmental Studies 360 Class (Ryan et al., 2002).

Because of the numerous studies that show elevated radioactivity or radionuclide levels in the Clarendon Springs Formation in the northern half of Vermont, it is the judgement of the Vermont Geological Survey that the entire Clarendon Springs Formation statewide be included in this category unless proven otherwise.

Vt nure preferred anomalies.shp: Three of the preferred uranium anomalies from the NURE airborne surveys have been checked on the ground and found to have elevated radioactivity and radionuclide levels. The two preferred anomalies in Milton and Colchester were confirmed by the ground-based work of Vanacek and Dorsey (1983); Vermont Dept. of Health (Whitten, 1988a, 1988b); Vermont Geological Survey/ Vermont Dept. of Health (2000); and Kim and Thompson (2002). The preferred anomaly in the Monkton and Starksboro area was confirmed via ground-based work of Corr (2002), in a Middlebury College Senior Thesis in the Geology Department.

Category 2v2.\* files This coverage represents as described on the *Compilation and Assessment of Radioactivity Data in Vermont* map legend "Category 2- elevated radioactivity indirectly measured in these areas via airborne or stream sediment surveys". These areas were delineated via airborne gamma ray spectrometer surveys and analysis of radioactive elements such as Uranium or Thorium in stream sediments. The geochemical measurement of U and Th in stream

sediments is considered an indirect method because stream sediments are mobile and have likely been transported some distance from their source. This coverage was assembled from the parts of a number of other coverages which are:

Vt nure preferred anomalies.\* files All preferred NURE airborne uranium anomalies that were not checked on the ground are part of this coverage.

Vt nure secondary anomalies.\* files All secondary NURE airborne uranium anomalies that were not checked on the ground are part of this coverage.

Vt nure stream.\* files All Uranium or Thorium/Uranium anomalies found in stream sediments in Vermont by the National Uranium Resource Evaluation (NURE) (Koller, 1979a and 1979b) are part of this coverage.

700+cps.shp, 500-700cps.shp These data layers were derived from U.S. Geological Survey Aeroradioactivity Map (Popenoe, 1964). The layers were merged into a single coverage. The 500-700 counts/second and 700+ counts/second layers were chosen from the Popenoe (1964) map because: 1) Popenoe (1964) considered 500-700 counts/second and 700+ counts/second intervals to represent medium high and high levels of radioactivity, respectively, in the text of his map; 2) Polygons in the 500-700 counts/second and 700+ counts/second range overlap with a number of polygons from the NURE airborne uranium surveys and stream sediment surveys; 3) Peter Thompson, who formerly worked for a uranium exploration company as a Geologist agreed that 500 counts/second and above was considered high (Thompson, pers. Comm., 2002).

The coverages Vt nure preferred anomalies.shp, Vt nure secondary anomalies.shp, Vt nure stream.shp, and 700+cps.shp, 500-700cps.shp were merged together to make the Category 2 layer for this map.

No Data.\* files This data layer represents the area of Vermont not covered by any known airborne or ground-based radioactivity surveys. The only data available for this area is the public water supply well locations (Pwsgwonly.\* files).

Category 3v2.\* files This coverage represents as described on the *Compilation and Assessment of Radioactivity Data in Vermont* map legend "Category 3- elevated radioactivity not measured in these areas other than public water supply wells with elevated gross alpha and some uranium occurrences (includes unsurveyed areas between flight lines)". This category encompasses all areas not included in category 1, Category 2, and No Data layers.

#### References:

Corr, B., 2002, Source Identification of the Starksboro Radionuclide Anomaly: A Field, Geochemical, and Petrographic Study of Elevated Radon Levels, Middlebury College Senior Thesis, 50 p.

Doll, C., 1961, Centennial Geologic Map of Vermont, Vermont Geological Survey, scale-1:250,000.

Dorsey, R.J. and Vanacek, D.M., 1983, Geologic and Radiometric Survey of the Clarendon Springs and Highgate Formations at the O-Brien Farm: Highgate Springs, Vermont, Vermont Geological Survey Open File Report 1983-1.

Kim J. and Thompson, P., 2002, Bedrock and Radionuclide Mapping in the Colchester Quadrangle, Vermont, Geological Society of America Abstracts with Programs, v. 34, #1, p. 17.

Koller, G.R., 1979a, Albany 1 degree X 2 degree NTMS area Connecticut, Massachusetts, New Hampshire, New York, and Vermont, Data Report, National Uranium Resource Evaluation, Hydrogeochemical and Stream Sediment Reconnaissance, Savannah River Laboratory, Aiken, South Carolina, 59 p.

Koller, G.R., 1979b, Glens Falls 1 degree X 2 degree NTMS area Connecticut, Massachusetts, New Hampshire, New York, and Vermont, Data Report, National Uranium Resource Evaluation, Hydrogeochemical and Stream Sediment Reconnaissance, Savannah River Laboratory, Aiken, South Carolina, 53 p.

McHone, J.G. and Wagener, H.D., 1980, Uranium Resource Evaluation, Glens Falls Quadrangle New York, Vermont, and New Hampshire: U.S. Dept. of Energy, Grand Junction, Colorado, 40 p.

McKeown, F.A., 1951, Reconnaissance of Radioactive Rocks of Vermont, New Hampshire, Connecticut, Rhode Island, and Southeastern New York: U.S. Geological Survey Report TEI-67 for U.S.A.E.C., Oak Ridge, TN, 48 p.

Mineral Resource Data System for Vermont (MRDS), U.S. Geological Survey digital database.

Field, M.T. and Truesdell, D.B., 1980, Uranium Resource Evaluation, Albany Quadrangle Massachusetts, New York, Connecticut, Vermont, and New Hampshire: U.S. Dept. of Energy, Grand Junction, Colorado, 57 p.

Parker, R., Whitten, E., and Selleck, 1988, Geologic controls on the distribution of Uranium and associated Radon in the Clarendon Springs Dolomite (Upper Cambrian-Lower Ordovician), Milton, Vermont: Green Mountain Geologist, v. 14, #4, p. 7.

Popenoe, P., 1964, Aeroradioactivity of parts of east-central New York and west-Central New England, U.S. Geological Survey Geophysical Investigations Map GP-358, scale- 1:250,000.

Ryan, P., Trombulak, S., Aldrich, L., Ausprey, I., Brower, B., Calvi, B., Groff, S., Hicks, C., Johnston, K., McBride, M., Perlow, L., Yazwinski, M., 2002, A Survey of Groundwater Composition in Northern Addison County, Vermont: Geologic Sources of Contamination, Environmental Science Practicum research report: Environmental Studies Program, Middlebury College, Middlebury, Vermont.

Texas Instruments, 1976, Airborne Geophysical Survey of a Portion of New England, U.S. Energy Research and Development Administration Open File Report GJO-1666-1, 73 p.

Vanacek, D.M. and Dorsey, R.J, 1983, Geologic and Radiometric Survey of the Sweeney Farm: Milton, Vermont, Vermont Geological Survey Open File Report 1983-2.

Vermont Geological Survey, 2000, Memo to the Vermont Dept. of Health regarding "Colchester/Milton Radionuclides", 6 p., 2 figures.

Whitten, E., 1988a, Paleoenvironmental interpretation and history of Uranium enrichment and resultant Radon gas genesis of the Clarendon Springs Dolomite, Milton, Vermont, Green Mountain Geologist, v. 15, #1, p. 11-12.

Whitten, E., 1988b, The Geology, Radioactivity, and Uranium Mineralization of the Clarendon Springs Dolostone, Milton, Vermont, Senior Thesis in the Environmental Studies Department, University of Vermont, 95 p.

## **Plate II and Associated GIS Layers: Airborne Radioactivity Coverage of Vermont**

### **NURE Flight Lines with Buffers Data Layer**

#### Required files:

flinrbuff1.dbf, flinrbuff1.shp, flinrbuff1.shx

GIS coverage of flight lines with buffers from airborne Texas Instruments radiometric survey completed for the U.S. Dept. of Energy, National Uranium Resource Evaluation (NURE) in 1976. The thickness of the flight lines with buffers indicates the approximate ground surface area that was surveyed by the flights. Each line is approximately 1250 m wide and this value was obtained by averaging the widths of the airborne anomalies shown on the NURE Airborne data maps. This survey covered all but the northeastern most part of Vermont. This data was scanned from 1:250,000 scale paper maps in the Vermont Geological Survey archives. The map was scanned into a tiff file using Truinfo software and a Titan scanner, converted to a dbf file using Evscan software, converted to an Arcinfo coverage using PC Arcinfo, and georectified and digitized in PC Arcinfo. Buffers to the flight lines were added in Arcview 3.2a.

#### Reference:

Texas Instruments, 1976, Airborne Geophysical Survey of a Portion of New England, U.S. Energy Research and Development Administration Open File Report GJO-1666-1, 73 p.

### **Popenoesurveyedarea Data Layer**

#### Required Files:

popenoesurveyedarea.dbf, popenoesurveyedarea.shp, popenoesurveyedarea.shx

GIS coverage of area of Vermont covered by U.S. Geological Survey airborne geophysical survey (modified from Popenoe, 1964). This data was scanned from a 1:250,000 scale paper map in the Vermont Geological Survey archives. The data was scanned into a tiff file using Truinfo

software and a Titan scanner, georectified using ERDAS Imagine, and digitized using Arcview 3.2a.

Reference:

Popenoe, P., 1964, Aeroradioactivity of parts of east-central New York and west-Central New England, U.S. Geological Survey Geophysical Investigations Map GP-358, scale- 1:250,000.

**Plate III and Associated GIS Layers: NURE Aeroradiometric Anomalies**

Required Files

Vt nure preferred anomalies.dbf, Vt nure preferred anomalies.shp, Vt nure preferred anomalies.shx

Vt nure secondary anomalies.dbf, Vt nure secondary anomalies.shp, Vt nure secondary anomalies.shx

These are GIS coverages of anomaly areas delineated by Texas Instruments airborne radiometric survey in Vermont completed for the U.S. Dept. of Energy, National Uranium Resource Evaluation (NURE) in 1976. Preferred anomalies were thought to be more favorable for the presence of uranium than secondary anomalies. This data was scanned from 1:250,000 scale maps in the Vermont Geological Survey archives. The data was scanned into a tiff file using a Titan Scanner and Truinfo software, georectified in ERDAS Imagine, and digitized in Arcview 3.2a.

Reference:

Texas Instruments, 1976, Airborne Geophysical Survey of a Portion of New England, U.S. Energy Research and Development Administration Open File Report GJO-1666-1, 73 p.

**Plate IV and Associated GIS Layers: Modified Airborne Radiometric Map of Popenoe (1964), U.S. Geological Survey GP-358**

Required Files:

700+cps.dbf, 700+cps.shp, 700+cps.shx

500-700cps.dbf, 500-700cps.shp, 500-700cps.shx

100-300cps.dbf, 100-300cps.shp, 100-300cps.shx

300-500cps.dbf, 300-500cps.shp, 300-500cps.shx

unsurveyed.dbf, unsurveyed.shp, unsurveyed.shx

**In order to make the data layers display correctly using GIS software, the above order of layers must be used.**

The 5 data layers listed above were derived from the U.S.G.S. Aeroradioactivity Map of Popenoe (1964). The divisions (in counts per second (cps)) used correspond to those delineated by Popenoe (1964) in the text of the map and do not correspond directly to the divisions contoured on the map (100-300cps=exceptionally low; 300-500cps=medium low; ~500-700 medium high; 700+cps=high). If any part of the range of counts per second for a polygon on the

map fell within the divisions described above, then the polygon was assigned to this division. The unsurveyed.shp coverage shows the areas that were not surveyed by the Popenoe (1964) investigation. This data was scanned from the 1:250,000 scale Popenoe (1964) paper map in the Vermont Geological Survey archives. The data was scanned into a tiff file using a Titan Scanner and Truinfo software, georectified using ERDAS Imagine, and digitized in Arcview 3.2a.

Reference:

Popenoe, P., 1964, Aeroradioactivity of parts of east-central New York and west-Central New England, U.S. Geological Survey Geophysical Investigations Map GP-358, scale- 1:250,000.

**Plate V and Associated GIS Layers: NURE Ground-Based Uranium Surveys**

Required Files:

nureground.dbf, nureground.shp, nureground.shx

This GIS coverage of "Areas Favorable for Uranium Deposits" was delineated by National Uranium Resource Evaluation (NURE) ground-based operations of McHone and Wagener (1980) and Field and Truesdell (1980). This data was digitized from 1:250,000 scale paper maps in the Vermont Geological Survey archives. This coverage was first scanned into a tiff file using a Titan scanner and Truinfo software, georectified using ERDAS Imagine, and digitized in Arcview 3.2a.

References:

McHone, J.G. and Wagener, H.D., 1980, Uranium Resource Evaluation, Glens Falls Quadrangle New York, Vermont, and New Hampshire: U.S. Dept. of Energy, Grand Junction, Colorado, 40 p.

Field, M.T. and Truesdell, D.B., 1980, Uranium Resource Evaluation, Albany Quadrangle Massachusetts, New York, Connecticut, Vermont, and New Hampshire: U.S. Dept. of Energy, Grand Junction, Colorado, 57 p.

**Plate VI and Associated GIS Layers: NURE Stream Sediment Data**

Required Files

Vt nure stream.dbf, Vt nure stream.shp, Vt nure stream.shx

This is a GIS coverage of Uranium or Thorium/Uranium anomalies found in stream sediments in Vermont by the National Uranium Resource Evaluation (NURE) (Koller, 1979a, 1979b). This data was digitized from 1:250,000 scale maps in the Vermont Geological Survey archives. The data was scanned into a tiff file using a Titan Scanner and Truinfo software, georectified in ERDAS Imagine, and digitized in Arcview 3.2a.

References:

Koller, G.R., 1979a, Albany 1 degree X 2 degree NTMS area Connecticut, Massachusetts, New

Hampshire, New York, and Vermont, Data Report, National Uranium Resource Evaluation, Hydrogeochemical and Stream Sediment Reconnaissance, Savannah River Laboratory, Aiken, South Carolina, 59 p.

Koller, G.R., 1979b, Glens Falls 1 degree X 2 degree NTMS area Connecticut, Massachusetts, New Hampshire, New York, and Vermont, Data Report, National Uranium Resource Evaluation, Hydrogeochemical and Stream Sediment Reconnaissance, Savannah River Laboratory, Aiken, South Carolina, 53 p.

### **Plate VII and Associated GIS Layers: Clarendon Springs Formation**

#### **Required Files**

cspolys.dbf, cspolys.shp, cspolys.shx

GIS coverage of the Clarendon Springs Formation in Vermont. This coverage was digitized in Arcview 3.2a from a georectified image of the 1:250,000 scale Centennial Geologic Map of Vermont (Doll, 1961). The georectified image was converted from NAD27 to NAD 83. The georectified image file that the Clarendon Springs Formation data layer was digitized from is included and is called "Vtgeo-rec.jpg".

#### **Reference:**

Doll, C., 1961, Centennial Geologic Map of Vermont, Vermont Geological Survey, scale-1:250,000 (Digital Image Version).

### **Plate VIII and Associated GIS Layers: Gross Alpha for Public Water Supply Wells in Vermont that Utilize Groundwater**

#### **Required Files**

Pwsgwonlys.dbf, Pwsgwonly.shp, Pwsgwonly.shx

The Pwsgwonly.shp point coverage shows the locations of all public water supplies in Vermont that are utilizing a groundwater source (surface water bodies have been removed); this coverage was extracted using Arcview 3.2a from a grossalpha.shp coverage produced by the Water Supply Division of the Vermont Department of Environmental Conservation. Internal to this coverage is a max result field that gives the unadjusted gross alpha result (in picocuries/ liter) for each of the wells.

### **Plate IX and Associated GIS Layers: Uranium Occurrences in Vermont**

#### **Required Files**

Vt mwu.dbf, Vt mwu.shp, Vt mwu.shx  
MRDS usitesii.dbf, MRDS usitesii.shp, MRDS usitesii.shx

These are GIS point coverages of places where uranium has been reported on the ground. Vt mwu.shp are locations where McHone and Wagener (1980) identified uranium on the ground

based on geophysical and geochemical techniques as part of the National Uranium Resource Evaluation (NURE). The McHone and Wagener (1980) uranium occurrences were made into a point coverage in PC Arcinfo from original latitudes and longitudes.

Mineral Resource Data System (MRDS) usitesii.shp are locations uranium or thorium occurrences or prospects have been reported as compiled by the U.S. Geological Survey Mineral Resource Data System (MRDS). The MRDS was a cooperative effort between the U.S. Geological Survey and the Vermont Geological Survey. Many of the locations are common between the McHone and Wagener (1980) and MRDS datasets. The MRDS database for Vermont was received from the U.S. Geological Survey and the uranium and thorium occurrences in this dataset were selected out and made into a shape file.

#### References

McHone, J.G. and Wagener, H.D., 1980, Uranium Resource Evaluation, Glens Falls Quadrangle New York, Vermont, and New Hampshire: U.S. Dept. of Energy, Grand Junction, Colorado, 40 p.

Mineral Resource Data System for Vermont, U.S. Geological Survey digital database.