

From: PDR Resource [mailto:PDR.Resource@nrc.gov]
Sent: Wednesday, February 04, 2009 6:56 AM
To: lakosh@gci.net
Cc: Fred Lyon; Scott Burnell; Tanya Mensah
Subject: RE: questions about your NRC document request

Tom Lakosh,

I am responding to your inquiry, which was recently received by the Nuclear Regulatory Commission's Public Document Room (NRC/PDR).

I searched ADAMS, NRC's Agencywide Documents Access and Management System, using "volcanism" and "ashplume" as keywords. The following citations are my search results; you can pull up any one of these documents in Web-based ADAMS <http://www.nrc.gov/reading-rm/adams/web-based.html> with their accession numbers:

Accession Number: ML030430473
Estimated Page Count: 3
Document Date: 2/12/2003
Document Type: Memoranda
Availability: Publicly Available
Title: Presentation of Paper at the 2003 International High-Level Radioactive Waste Management Conference.
Author Name: Greeves J T
Author Affiliation: NRC/NMSS/DWM
Addressee Name: Craig J W
Addressee Affiliation: NRC/EDO/AO
Docket Number: WM-00011
License Number:
Case/Reference Number: HLWR
Document/Report Number:
Keyword: AGC, dml1, source term, TSPA Model, Volcanism, Yucca Mountain
Package Number:
Document Date Received:
Date Docketed:
Related Date:
Comment:
Vital Records Category: No
Document Status: final
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: No
Date to be Released: 2/21/2003
Distribution List Codes:
Contact Person: Richard Codell (301) 415-8167
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ML030430473.pdf

File Size: 6853

Accession Number: ML003730003
Estimated Page Count: 22
Document Date: 6/6/2000
Document Type: Meeting Briefing Package/Handouts, Slides and Viewgraphs
Availability: Publicly Available
Title: TSPA-SR Models: Disruptive Events.
Author Name: Sauer M
Author Affiliation: Sandia National Labs (SNL), US Dept of Energy, Office of Civilian Radioactive Waste Mgmt (OCRWM)
Addressee Name:
Addressee Affiliation: NRC/NMSS
Docket Number: WM-00011
License Number: PRE
Case/Reference Number:
Document/Report Number:
Keyword: airborne transport of radionuclides, ASHPLUME, disruptive events, dml1, features, events, and processes, FEPs, Igneous Intrusion, mac4, oarc20020710dnw, oarc20021114dnw, OARC20071003MAB8, performance assessment, seismic activity, Site Recommendation, TSPA-SR, Volcanism, Yucca Mountain
Package Number:
Document Date Received: 6/6/2000
Date Docketed:
Related Date: 6/6/2000
Comment:
Vital Records Category: No
Document Status: final
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: No
Date to be Released: 8/1/2003
Distribution List Codes:
Contact Person:
Text Source Flag: OCR'd from scanned image - no corrections made
Document Sensitivity: Non-Sensitive
File Name: ML003730003.pdf
File Size: 2485280

Accession Number: ML003729535
Estimated Page Count: 5
Document Date: 6/6/2000
Document Type: Highlights, Letter, Meeting Minutes, Meeting Summary
Availability: Publicly Available
Title: U.S. Nuclear Regulatory Commission/U.S. Department of Energy Technical Exchange Meeting on Total System Performance Assessments (June 6-7, 2000)
Author Name: Gil A V, Stablein N K
Author Affiliation: US Dept of Energy, Office of Repository Development
Addressee Name:
Addressee Affiliation: NRC/NMSS
Docket Number: WM-00011
License Number: PRE

Case/Reference Number: A10214
Document/Report Number:
Keyword: engineered barriers, Gap Analysis, GoldSim, Issue Resolution, KTI Issues, Model Abstraction, Multiple Barriers, nxp, OARC20000831bac4, oarc20021007dnw, oarc20021114dnw, oarc20030429mmn, Overall Performance Objective, performance assessment, Quality Assurance, Scenario Analysis, Site Recommendation, Site Recommendation Considerations Report, SRCR, Sufficiency Review, Technical Exchange, TSPA, TSPAI, Volcanism
Package Number:
Document Date Received:
Date Docketed:
Related Date: 6/6/2000
Comment: Rose Conn-Holden
Vital Records Category: No
Document Status: Draft
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: No
Date to be Released: 8/19/2003
Distribution List Codes:
Contact Person: Firth J R
Text Source Flag: OCR'd from scanned image - no corrections made
Document Sensitivity: Non-Sensitive
File Name: S107263.pdf
File Size: 345841

Accession Number: ML061600242
Estimated Page Count: 4
Document Date: 6/8/2006
Document Type: Committee Letter Report
Availability: Publicly Available
Title: Future Volcanism at Yucca Mountain - Comments on the Igneous Intrusion Scenario
Author Name: Ryan M T
Author Affiliation: NRC/ACNW
Addressee Name: Diaz N J
Addressee Affiliation: NRC
Docket Number: WM-00011
License Number:
Case/Reference Number: WH 137J
Document/Report Number: R-0240
Keyword: 170th ACNW Meeting, Future Volcanism, igneous intrusion scenario, SUNSI Review Complete, Yucca Mountain
Package Number:
Document Date Received:
Date Docketed:
Related Date:
Comment:
Vital Records Category: No
Document Status:
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: ACNW
Date to be Released: 6/22/2006

Distribution List Codes:
Contact Person: Coleman N M, 301-415-7656
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ML061600242.pdf
File Size: 180735

Accession Number: ML061640308
Estimated Page Count: 3
Document Date: 6/9/2006
Document Type: Committee Letter Report
Availability: Publicly Available
Title: Future Volcanism at Yucca Mountain - Comments on the NRC Staff Model for the Fluvial Redistribution of Volcanic Tephra
Author Name: Ryan M T
Author Affiliation: NRC/ACNW
Addressee Name: Diaz N J
Addressee Affiliation: NRC
Docket Number: WM-00011
License Number:
Case/Reference Number: WH 137J
Document/Report Number: R-0243
Keyword: 170th ACNW Meeting, Fluvial Redistribution of Volcanic Tephra, Future Volcanism, NRC Staff Model, SUNSI Review Complete, Yucca Mountain
Package Number:
Document Date Received:
Date Docketed:
Related Date:
Comment:
Vital Records Category: No
Document Status:
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: ACNW
Date to be Released: 6/22/2006
Distribution List Codes:
Contact Person: Coleman N 415-7656
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ML061640308.pdf
File Size: 473115

Accession Number: ML063250235
Estimated Page Count: 12
Document Date: 11/13/2006
Document Type: Memoranda, Trip Report
Availability: Publicly Available
Title: Attendance at US Nuclear Waste Technical Review Board (US NWTRB) Workshop on Localized Corrosion of Alloy 22 in Yucca Mountain Environments, and Workshop 3 of the Probabilistic Volcanic Hazard Analysis Update (PVHA-U) for Yucca Mountain.
Author Name: Snodderly M R

Author Affiliation: NRC/ACNW, NRC/ACRS
Addressee Name: Larkins J T
Addressee Affiliation: NRC/ACNW, NRC/ACRS
Docket Number: WM-00011
License Number: PRE
Case/Reference Number: -nr, WH 112, WH 133
Document/Report Number:
Keyword: ACRS/ACNW-003, jef1, laf1, oarc20070112dam=Added -nr to case/reference, SUNSI Review Complete, Yucca Mountain, NWTRB, Volcanism, Corrosion
Package Number:
Document Date Received:
Date Docketed:
Related Date: 9/25/2006
Comment:
Vital Records Category: No
Document Status:
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: No
Date to be Released: 11/30/2006
Distribution List Codes:
Contact Person: Coleman NM, ACRS, 301-415-7656
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ML063250235.pdf
File Size: 1056940

Accession Number: ML063530748
Estimated Page Count: 165
Document Date: 12/19/2006
Document Type: Report, Technical
Availability: Publicly Available
Title: DRAFT Report - Volcanism White Paper
Author Name: Coleman N
Author Affiliation: NRC/ACNW
Addressee Name:
Addressee Affiliation:
Docket Number:
License Number:
Case/Reference Number: Yucca Mountain
Document/Report Number:
Keyword: SUNSI Review Complete, Yucca Mountain, Volcanism, probability, consequences
Package Number:
Document Date Received:
Date Docketed:
Related Date:
Comment:
Vital Records Category: No
Document Status:
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: ACNW

Date to be Released: 12/20/2006
Distribution List Codes:
Contact Person: Coleman, N. 301-415-7656
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ACNW Draft White Paper Igneous Activity at Yucca Mtn Dec 19 2006.pdf
File Size: 12986368

Accession Number: ML070110594
Estimated Page Count: 3
Document Date: 12/29/2006
Document Type: Letter
Availability: Publicly Available
Title: Letter to Stakeholders (E-mail) - Transmittal of Draft White Paper on Igneous Activity at Yucca Mountain, and Invitation to ACNW's Working Group Meeting on the "State of Knowledge Regarding Potential Igneous Activity at Yucca Mountain."
Author Name: Larkins J T
Author Affiliation: NRC/ACNW
Addressee Name:
Addressee Affiliation:
Docket Number: WM-00011
License Number: PRE
Case/Reference Number: -nr, WH 133
Document/Report Number:
Keyword: ACRS/ACNW-003, laf1, nxp, oarc20070627rbs=Added -nr to case/reference, SUNSI Review Complete, Volcanism Yucca Mountain White Paper
Package Number: ML070110520
Document Date Received:
Date Docketed:
Related Date:
Comment:
Vital Records Category: No
Document Status:
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: ACNW
Date to be Released: 3/30/2007
Distribution List Codes:
Contact Person: Coleman NM, ACNW, 301-415-7656
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ML070110594.pdf
File Size: 74584

Accession Number: ML070120262
Estimated Page Count: 3
Document Date: 12/29/2006
Document Type: Letter
Availability: Publicly Available

Title: Letter to Mr. R. Loux: Transmittal of Draft White Paper on Igneous Activity at Yucca Mountain, and Invitation to ACNW's Working Group Meeting on the "State of Knowledge Regarding Potential Igneous Activity at Yucca Mountain."

Author Name: Larkins J T

Author Affiliation: NRC/ACNW

Addressee Name: Loux R R

Addressee Affiliation: State of NV, Agency for Nuclear Projects, State of NV, Office of the Governor

Docket Number: WM-00011

License Number: PRE

Case/Reference Number: WH 133

Document/Report Number:

Keyword: ACRS/ACNW-003, laf1, nxp, SUNSI Review Complete, Volcanism Yucca Mountain White Paper

Package Number: ML070110520

Document Date Received:

Date Docketed:

Related Date:

Comment:

Vital Records Category: No

Document Status:

Media Type: Electronic

Physical File Location: ADAMS

FACA Document: ACNW

Date to be Released: 3/30/2007

Distribution List Codes:

Contact Person:

Text Source Flag: Native Application

Document Sensitivity: Non-Sensitive

File Name: ML070120262.pdf

File Size: 73587

Accession Number: ML070170245

Estimated Page Count: 3

Document Date: 12/29/2006

Document Type: Letter

Availability: Publicly Available

Title: Letter to Mr. Sproat: Transmittal of Draft White Paper on Igneous Activity at Yucca Mountain, and Invitation to ACNW's Working Group Meeting on the "State of Knowledge Regarding Potential Igneous Activity at Yucca Mountain."

Author Name: Larkins J T

Author Affiliation: NRC/ACNW

Addressee Name: Sproat E F

Addressee Affiliation: US Dept of Energy, Office of Civilian Radioactive Waste Mgmt (OCRWM)

Docket Number: WM-00011

License Number: PRE

Case/Reference Number: -nr, WH 133

Document/Report Number:

Keyword: ACRS/ACNW-003, laf1, nxp, oarc20070627rbs=Added -nr to case/reference, SUNSI Review Complete, Volcanism Yucca Mountain White Paper

Package Number: ML070110520

Document Date Received:

Date Docketed:

Related Date:

Comment:
Vital Records Category: No
Document Status:
Media Type: Electronic
Physical File Location: ADAMS
FACA Document: No
Date to be Released: 3/30/2007
Distribution List Codes:
Contact Person: Coleman NM, ACNW, 301-415-7656
Text Source Flag: Native Application
Document Sensitivity: Non-Sensitive
File Name: ML070170245.pdf
File Size: 58508

I hope you will find this information to be useful.

Adam
Technical Librarian
Public Document Room
Nuclear Regulatory Commission
(301) 415-4737
(800) 397-4209
(301) 415-3548 (FAX)
PDR.Resource@nrc.gov
<http://www.nrc.gov/reading-rm/pdr.html>
[8:00am - 4:00pm, Eastern Time, Monday - Friday]

From: lakosh@gci.net [mailto:lakosh@gci.net]
Sent: Wednesday, February 04, 2009 10:29 AM
To: PDR Resource
Subject: RE: questions about your NRC document request

Karen;

With assistance of Adam, I finally replicated the search you suggested below for Long Valley but the documents have nothing to do with the Long Valley super volcano in California and are instead referencing the long term disposition of the West Valley reprocessing plant in New York. Adam said he would continue to work on the document search and send me some relevant results. Would you please coordinate with him regarding the search for relevant documents? Tom (907) 563-7380

From: PDR Resource [mailto:PDR.Resource@nrc.gov]
Sent: Friday, January 30, 2009 11:56 AM
To: lakosh@gci.net
Subject: RE: questions about your NRC document request

Tom,

I have only come up with a few things, but I wanted to get back to you before we leave for the day.

I have also forwarded your e-mail to the NRC Office of Public Affairs (opa.resource@nrc.gov ; 301-415-8200), asking for an expert on this topic. OPA has a list of technical experts in the agency. So I will let you know if I hear back from them.

There are 23 publicly available documents in ADAMS with Long Valley in the Title. Nothing came up when I searched Yellowstone. Here is how I searched the documents with Long Valley in Title - some may be helpful in your search.

Begin at Web-based ADAMS, <http://www.nrc.gov/reading-rm/adams/web-based.html> .
Click on "Begin ADAMS Search", and then on "Advanced Search".
In the Title field, enter Long Valley (with no quotes).
Click Search.
You should see a list of 23 document titles.

To view the official agency record, you will need to click on the PDF Image File, not the linked title.

There may also be documents on this topic in the Energy Citations Database from the Department of Energy, at <http://www.osti.gov/energycitations/index.jsp> .

Search in their Fielded Search at <http://www.osti.gov/energycitations/advancedsearch.jsp> .
Example searches I did was the term Yellowstone and Long Valley (as separate searches) in the Title field.

I will let you know what I find out from the Office of Public Affairs staff, and please let me know if you have any questions on searching ADAMS or need more information. So far, I also could not locate any documents in the microfiche.

Thanks.

Sincerely,
Karen
USNRC/PDR
301-415-4737
pdr.resource@nrc.gov

From: lakosh@gci.net [mailto:lakosh@gci.net]
Sent: Friday, January 30, 2009 12:31 PM
To: PDR Resource
Subject: RE: questions about your NRC document request

Karen;

That sounds like a reasonable process as if there were documents generated in the ADAMS time frame they would be most relevant. I've already done multiple searches using "volcanic ash", modified by

reactor and similar searches but could only find reference to dispersion of waste from the volcano below Yucca Mt. I may have missed some documents but I suspect that if any relevant studies were done, they pre-dated the commissioning of most of our existing reactors. Please call ASAP anytime, 24/7, if you find a relevant publication as Fred is waiting on me to proceed with a 2.206 and/or a 2.802 review of the need for additional mitigation efforts. Tom (907) 563-7380

From: PDR Resource [mailto:PDR.Resource@nrc.gov]
Sent: Friday, January 30, 2009 5:48 AM
To: lakosh@gci.net
Subject: questions about your NRC document request

Tom,

I have read the e-mails below, and am working on answering your request for documents regarding the risk/probability of catastrophic eruptions from Yellowstone and Long Valley and their potential effect on reactor operations.

Are you interested in recent documents? Do you have a specific time-frame in mind? Please let me know if there are specific years, so I can narrow down my search.

The reason I ask is because our microfiche collection pre-dates ADAMS, the Agencywide Documents Access and Management System at <http://www.nrc.gov/reading-rm/adams.html>, which came online on November 1, 1999. However, some documents dated before this date have been scanned into ADAMS.

The easiest way to search ADAMS is via the Web-based search, at <http://www.nrc.gov/reading-rm/adams/web-based.html>.

There is a different database we search for documents in our microfiche collection. Our copy service contractor copies our microfiche, and other documents, for the public. Information about our copy service is at <http://www.nrc.gov/reading-rm/pdr/copy-service.html> and at <http://www.nrc.gov/reading-rm/pdr/fee-schedule.html>.

I will begin by searching ADAMS for electronic documents on your topic. If you would like me to search our microfiche collection as well (that goes back to at least 1975), please also let me know.

Thanks, and sorry about the delay in getting back to you.

Sincerely,
Karen
Librarian
USNRC Public Document Room
301-415-4737; 1-800-397-4209
(8 am - 4 pm, Eastern Time, Mon-Fri)
pdr.resource@nrc.gov

From: lakosh@gci.net [mailto:lakosh@gci.net]
Sent: Tuesday, January 27, 2009 11:53 AM

To: PDR Resource
Subject: ATTN: Karen FW: Rulemaking

Dear Karen;

You'll find discussion of the pertinent issue below. Mr. Lyon contended that the NRC concluded that the probability of a super eruption was too low to require planning for such events but later said he was unaware of any probability/risk analysis done on this topic. I would like to review any documents considered by the NRC regarding the risk/probability of catastrophic eruptions from Yellowstone and Long Valley and their potential effect on reactor operations. Tom (907) 563-7380

From: Tom Lakosh [mailto:lakosh@gci.net]
Sent: Friday, January 23, 2009 7:39 AM
To: 'Fred Lyon'
Subject: RE: Rulemaking

Mr. Lyon;

My decision on which process to pursue, 2.206 and/or 2.802, will depend largely on the pertinent information requested in our conversation regarding the risk assessment of super eruptions from Yellowstone or Long Valley and the mitigation measures appropriate to such events. I am still unsure of the extent of effects on reactor operations and the applicable regulations and guidelines that control such operations. While the potential impact to the ultimate heat sink regulations is clear, the other potential impacts, (e.g. availability of plant consumables and retention/accommodation of personnel, etc.), could be far reaching both in terms of geographic and mitigation requirements given such a catastrophic event. I could envision proceeding with both administrative procedures where both immediate orders to resolve the probability issue is warranted and new regulations to address design issues would be applicable as well. I hope we can discuss the ramifications to a greater extent and assess the reliability of the risk assessment that have been performed to date and any need to update those assessments given subsequent dynamic events that may have altered the prior assessment scope and/or parameters. Tom (907) 563-7380

From: Fred Lyon [mailto:Fred.Lyon@nrc.gov]
Sent: Friday, January 23, 2009 6:53 AM
To: lakosh@gci.net
Subject: Rulemaking

Mr. Lakosh, based on your telephone call to me this morning, I recommend you refer to the NRC webpage <http://www.nrc.gov/about-nrc/regulatory/rulemaking.html> for links that discuss the rulemaking process. I will call you back to discuss your decision as to whether to proceed with the 2.206 process. Thanks, Fred Lyon

From: Tom Lakosh [mailto:lakosh@gci.net]
Sent: Wednesday, December 31, 2008 7:32 PM
To: 'allegation@nrc.gov'
Cc: 'ucs@ucsusa.org'
Subject: Reserve water for extended blow down

Dear NRC;

The earthquakes at Yellowstone Lake continue in a pattern suggesting that a highly pressurized chimney has developed between the surface and a depth of 7.2 km. If the worst case scenario ensues, dozens of plants will have to cease utilization of surface water within hours and clean reserve cooling water to replace steam lost in blow downs and evaporation at spent fuel storage ponds extending for months on end will be very hard to come by. I might suggest an order by the NRC to all operating US reactors detailing the threat and requiring immediate acquisition of sufficient temporary water storage, water filtration systems and pumps with spare parts to accommodate the loss of direct access to surface water for a period of no less than three months. Arrangements should be made in advance with local pumping and firefighting assets to fill the acquired water storage in a timely manner should notice of eruption be issued. If the dreaded event happens in short order, it will be necessary for the NRC to obtain cooperation of the USCG to seize all available tank vessels for diversion to nuclear facilities to provide the required clean water storage. I've supplied some links to storage bladders below but full reserve capacity may not be needed where the use of several large bladders may permit sufficient settling time for stored ash-contaminated water augmented by a filtration process between two of the bladders. If time allows, the bedding for all pillow tanks should be established for all plants West of the Mississippi and pre-positioning of some of the tanks with emergency contracts with construction equipment for additional bed preparation should be maintained elsewhere. If towable/floating tanks are acquired, no bedding is required but anchor systems should be pre-positioned to allow for timely deployment/filling of the bladders.

Sincerely, Tom Lakosh (907) 563-7380

http://www.canflexinc.com/ocean_towable_bladders_en.cfm
<http://www.mpccontainment.com/military-applications.shtml?gclid=CKvu4vy17JcCFSAUagod5FUnEA>
http://www.bergco.com/integrated_systems/products/khcms_tanksdivision_largecapacitybladder.aspx
http://www.interstateproducts.com/fuel_storage_bladders.htm
<http://www.musthane.com/english/products/tanks-muststore.htm>
http://store.interstateproducts.com/water_bladders.htm?gclid=CNTd46O57JcCFQ8Qagodlw8UEA

From: Tom Lakosh [mailto:lakosh@gci.net]
Sent: Tuesday, December 30, 2008 7:47 AM
To: 'allegation@nrc.gov'
Cc: 'ucs@ucsusa.org'
Subject: Shutdown after Yellowstone eruption

Dear NRC;

Would please quickly devise a plan for immediate systematic shutdown and cooling of all reactors that may be downwind of a major Yellowstone caldera eruption? I am concerned that water pumps will not survive for long with significant ash contamination in feed water and there should be a plan to dissipate latent heat in reactor cores and spent fuel storage given a fairly short pump lifetime after ash fall. While the quakes listed below may not be anything more than hydrothermal indigestion, the long term and wide spread radioactive contamination from a failure to properly plan for multiple ash-induced water pump failures is too catastrophic to evade a modicum of preparatory planning.

Sincerely, Tom Lakosh (907) 563-7380

Update time = Tue Dec 30 16:18:40 UTC 2008

Here are the earthquakes in the [Map Centered at 44°N, 110°W area](#), most recent at the top.

(Some early events may be obscured by later ones.)

Click on the underlined portion of an earthquake record in the list below for more information.

<u>MAG</u>	<u>UTC DATE-TIME</u> <u>y/m/d h:m:s</u>	<u>LAT</u> <u>deg</u>	<u>LON</u> <u>deg</u>	<u>DEPTH</u> <u>km</u>	<u>LOCATION</u>
MAP 2.4	2008/12/30 11:59:07	44.523	-110.401	10.3	58 km (36 mi) ESE of West Yellowstone, MT
MAP 1.7	2008/12/30 01:35:08	44.530	-110.361	2.1	61 km (38 mi) ESE of West Yellowstone, MT
MAP 1.5	2008/12/30 01:15:37	44.522	-110.360	2.1	61 km (38 mi) ESE of West Yellowstone, MT
MAP 2.1	2008/12/30 00:51:20	44.505	-110.373	0.2	61 km (38 mi) ESE of West Yellowstone, MT
MAP 1.0	2008/12/30 00:41:35	44.522	-110.361	1.8	61 km (38 mi) ESE of West Yellowstone, MT
MAP 2.8	2008/12/30 00:36:39	44.525	-110.362	1.2	61 km (38 mi) ESE of West Yellowstone, MT
MAP 2.4	2008/12/29 21:25:15	44.525	-110.360	2.0	61 km (38 mi) ESE of West Yellowstone, MT
MAP 1.6	2008/12/29 21:18:51	44.521	-110.362	2.2	61 km (38 mi) ESE of West Yellowstone, MT
MAP 1.8	2008/12/29 21:18:36	44.522	-110.359	2.1	61 km (38 mi) ESE of West Yellowstone, MT
MAP 2.9	2008/12/29 20:38:25	44.514	-110.381	2.1	60 km (37 mi) ESE of West Yellowstone, MT
MAP 2.3	2008/12/29 20:38:04	44.511	-110.385	2.3	60 km (37 mi) ESE of West Yellowstone, MT
MAP 1.0	2008/12/29 20:26:29	44.520	-110.355	2.2	62 km (38 mi) ESE of West Yellowstone, MT
MAP 1.9	2008/12/29 20:14:26	44.498	-110.364	2.3	62 km (38 mi) ESE of West Yellowstone, MT
MAP 1.4	2008/12/29 20:13:31	44.508	-110.359	2.2	62 km (38 mi) ESE of West Yellowstone, MT
MAP 2.2	2008/12/29 19:56:46	44.522	-110.365	1.2	61 km (38 mi) ESE of West Yellowstone, MT
MAP 1.2	2008/12/29 19:53:50	44.511	-110.377	2.2	60 km (37 mi) ESE of West Yellowstone, MT
MAP 1.1	2008/12/29 19:46:13	44.515	-110.386	2.4	59 km (37 mi) ESE of West Yellowstone, MT
MAP 1.7	2008/12/29 19:44:50	44.525	-110.373	0.0	60 km (37 mi) ESE of West Yellowstone, MT
MAP 1.7	2008/12/29 19:40:27	44.511	-110.379	2.5	60 km (37 mi) ESE of West Yellowstone, MT
MAP 2.4	2008/12/29 19:37:07	44.502	-110.366	1.8	61 km (38 mi) ESE of West Yellowstone, MT

[MAP1.2](#) [2008/12/29 19:36:0844.521-110.3852.0](#)
[MAP1.7](#) [2008/12/29 19:35:2744.511-110.3852.4](#)
[MAP2.9](#) [2008/12/29 19:29:3844.513-110.3810.5](#)
[MAP2.5](#) [2008/12/29 19:28:5544.515-110.3810.0](#)
[MAP1.8](#) [2008/12/29 19:26:2144.519-110.3702.0](#)
[MAP1.5](#) [2008/12/29 19:24:4344.520-110.3422.3](#)
[MAP3.3](#) [2008/12/29 19:14:4944.521-110.3691.8](#)
[MAP1.2](#) [2008/12/29 18:47:4544.523-110.3712.1](#)
[MAP1.4](#) [2008/12/29 18:40:0044.533-110.3594.8](#)
[MAP1.1](#) [2008/12/29 16:32:1244.494-110.3602.4](#)
[MAP1.6](#) [2008/12/29 16:31:5544.491-110.3602.3](#)
[MAP1.2](#) [2008/12/29 16:15:2844.480-110.3632.3](#)
[MAP1.5](#) [2008/12/29 14:58:3744.486-110.3541.3](#)
[MAP1.7](#) [2008/12/29 10:25:1844.523-110.3712.4](#)
[MAP1.8](#) [2008/12/29 09:14:0444.527-110.3760.3](#)
[MAP2.4](#) [2008/12/29 08:57:5544.527-110.3780.5](#)
[MAP2.4](#) [2008/12/29 08:28:2444.527-110.3820.4](#)
[MAP2.0](#) [2008/12/29 05:30:3544.517-110.3721.0](#)
[MAP2.3](#) [2008/12/29 05:30:0444.477-110.3496.5](#)
[MAP1.7](#) [2008/12/29 05:29:2344.489-110.3544.2](#)
[MAP2.4](#) [2008/12/29 05:23:3644.516-110.3616.4](#)
[MAP1.9](#) [2008/12/29 04:29:1844.522-110.3851.0](#)
[MAP2.8](#) [2008/12/29 04:25:5344.514-110.3700.1](#)
[MAP2.6](#) [2008/12/28 23:57:5644.521-110.3711.4](#)
[MAP2.0](#) [2008/12/28 23:08:2544.491-110.3901.7](#)

59 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

60 km (38 mi) ESE of West
Yellowstone, MT

63 km (39 mi) ESE of West
Yellowstone, MT

**60 km (38 mi) ESE of West
Yellowstone, MT**

60 km (37 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

62 km (39 mi) ESE of West
Yellowstone, MT

62 km (39 mi) ESE of West
Yellowstone, MT

62 km (39 mi) ESE of West
Yellowstone, MT

63 km (39 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

59 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

63 km (39 mi) ESE of West
Yellowstone, MT

63 km (39 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

59 km (37 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

60 km (37 mi) ESE of West
Yellowstone, MT

[MAP3.1](#) [2008/12/28 19:55:1744.511-110.3530.7](#)

[MAP3.0](#) [2008/12/28 19:32:1544.511-110.3562.7](#)

[MAP2.8](#) [2008/12/28 15:37:4044.514-110.3590.0](#)

[MAP2.2](#) [2008/12/28 09:25:1444.508-110.3641.9](#)

[MAP3.2](#) [2008/12/28 09:23:5744.511-110.3610.4](#)

[MAP1.5](#) [2008/12/28 08:41:3344.509-110.3592.5](#)

[MAP2.2](#) [2008/12/28 08:23:4144.506-110.3690.1](#)

[MAP1.1](#) [2008/12/28 08:22:4644.499-110.3622.5](#)

[MAP1.3](#) [2008/12/28 08:22:2444.499-110.3612.3](#)

[MAP1.7](#) [2008/12/28 08:15:3344.499-110.3642.1](#)

[MAP1.0](#) [2008/12/28 08:14:5844.501-110.3805.3](#)

[MAP1.9](#) [2008/12/28 07:16:1344.513-110.3742.0](#)

[MAP2.5](#) [2008/12/28 07:15:1844.495-110.3590.0](#)

[MAP2.5](#) [2008/12/28 06:37:4144.492-110.3562.6](#)

[MAP2.0](#) [2008/12/28 06:37:2044.497-110.3792.1](#)

[MAP1.9](#) [2008/12/28 05:28:4944.498-110.3832.3](#)

[MAP1.9](#) [2008/12/28 05:28:0544.485-110.3712.5](#)

[MAP1.8](#) [2008/12/28 05:26:1444.484-110.3592.0](#)

[MAP1.2](#) [2008/12/28 05:26:0344.470-110.3555.2](#)

[MAP1.3](#) [2008/12/28 05:24:3944.489-110.3594.1](#)

[MAP2.8](#) [2008/12/28 05:23:5444.489-110.3542.5](#)

[MAP1.9](#) [2008/12/28 05:21:1644.480-110.3444.0](#)

[MAP1.7](#) [2008/12/28 05:20:1044.494-110.3792.4](#)

[MAP1.6](#) [2008/12/28 05:19:1144.492-110.3722.2](#)

[MAP3.9](#) [2008/12/28 05:15:5644.502-110.3660.3](#)

62 km (39 mi) ESE of West Yellowstone, MT

62 km (38 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

62 km (38 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

62 km (38 mi) ESE of West Yellowstone, MT

62 km (38 mi) ESE of West Yellowstone, MT

62 km (38 mi) ESE of West Yellowstone, MT

60 km (37 mi) ESE of West Yellowstone, MT

60 km (37 mi) ESE of West Yellowstone, MT

62 km (39 mi) ESE of West Yellowstone, MT

62 km (39 mi) ESE of West Yellowstone, MT

60 km (38 mi) ESE of West Yellowstone, MT

60 km (37 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

62 km (39 mi) ESE of West Yellowstone, MT

63 km (39 mi) ESE of West Yellowstone, MT

62 km (39 mi) ESE of West Yellowstone, MT

63 km (39 mi) ESE of West Yellowstone, MT

64 km (40 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

61 km (38 mi) ESE of West Yellowstone, MT

[MAP2.6](#) [2008/12/28 00:08:5044.493-110.3540.4](#)

[MAP3.3](#) [2008/12/27 22:30:0344.498-110.3584.3](#)

[MAP1.5](#) [2008/12/27 22:28:5344.500-110.3682.1](#)

[MAP1.8](#) [2008/12/27 22:27:3644.499-110.3672.5](#)

[MAP1.0](#) [2008/12/27 21:28:0644.500-110.3623.5](#)

[MAP1.6](#) [2008/12/27 21:22:0844.495-110.3722.6](#)

[MAP2.1](#) [2008/12/27 21:08:4944.496-110.3702.0](#)

[MAP3.2](#) [2008/12/27 20:26:2744.505-110.3642.4](#)

[MAP3.5](#) [2008/12/27 20:17:3344.488-110.3574.1](#)

[MAP2.3](#) [2008/12/27 18:56:3544.484-110.3670.5](#)

[MAP3.0](#) [2008/12/27 18:23:0744.495-110.3642.8](#)

[MAP2.0](#) [2008/12/27 18:21:3644.493-110.3627.2](#)

[MAP1.2](#) [2008/12/27 17:01:4644.484-110.3732.4](#)

[MAP2.7](#) [2008/12/27 17:01:0744.490-110.3661.2](#)

[MAP2.6](#) [2008/12/27 16:30:5444.498-110.3622.5](#)

63 km (39 mi) ESE of West
Yellowstone, MT

**62 km (39 mi) ESE of West
Yellowstone, MT**

61 km (38 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

62 km (38 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

**61 km (38 mi) ESE of West
Yellowstone, MT**

**62 km (39 mi) ESE of West
Yellowstone, MT**

62 km (38 mi) ESE of West
Yellowstone, MT

**62 km (38 mi) ESE of West
Yellowstone, MT**

62 km (38 mi) ESE of West
Yellowstone, MT

61 km (38 mi) ESE of West
Yellowstone, MT

62 km (38 mi) ESE of West
Yellowstone, MT

62 km (38 mi) ESE of West
Yellowstone, MT