



# CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES QUALITY ASSURANCE SURVEILLANCE REPORT

PROJECT NO: 20-1402-561

REPORT NO: 99-010

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**SURVEILLANCE SCOPE:** Surveillance Activity on Powdered and Hand Samples being sent to the Department of Energy (DOE)

**REFERENCE DOCUMENTS:** QAP-004, Surveillance Control Procedure

**STARTING DATE:** 5/18/99

**ENDING DATE:** 5/18/99

**QA REPRESENTATIVE:** Mark R. Ehnstrom

**PERSONS CONDUCTING TEST/EXAM/ACTIVITY:** D. Pickett

**SATISFACTORY FINDINGS:**

Surveillance activities were performed on powdered and hand samples being sent to the DOE. The 13 samples were chosen by Dr. Pickett. On the outside of each container the sample identification number was listed. This number was traced back to the sample custody log which contained information such as the date the sample was obtained, the scientific notebook and page number documenting this activity, and describing the location of the sample. All samples were verified as being samples obtained from the Pena Blanca site. The containers holding the powdered samples were secured with Parafilm tape. Both the hand samples and the powdered samples were sealed in zip-lock bags for transport. Prior to closing the box for shipment, activity measurements of the samples were taken with a meter currently within certification (Serial No. 82374). This reading showed that the samples had a specific activity of less than 100 cpm and less than 0.1 mR/hr.

**SATISFACTORY FINDINGS:** None

**NONCONFORMANCE REPORT NO:** N/A

**ATTACHMENTS:** Cover letter and additional information concerning the samples sent to the DOE.

**RECOMMENDATIONS/ACTIONS:** None

**APPROVED:**

CENTER DIRECTOR OF QUALITY ASSURANCE

**DATE:**

5/19/99

**DISTRIBUTION:**

- ORIGINAL - CENTER QA DIRECTOR / QA Records
- ORIGINATOR - M.R. Ehnstrom w/o attachments
- PRINCIPAL ENGINEER - D. Pickett w/o attachments
- ELEMENT MANAGERS - ALL w/o attachments
- B. Sagar
- H. Garcia w/o attachments

# Center for Nuclear Waste Regulatory Analyses

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(210) 522-5160 • FAX (210) 522-5155

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May 18, 1999

Los Alamos National Laboratories  
Attn: Mr. Mike Murrell  
SM-30  
Bikini Atoll Road  
Los Alamos, NM 87545

Subject: Samples from Peña Blanca

Dear Mr. Murrell:

As authorized by the U.S. Nuclear Regulatory Commission (NRC), enclosed are 13 rock samples from the Nopal I natural analog site. This shipment is in response to a request transmitted in an April 9, 1999, letter from S. Brocoum, Department of Energy (DOE) to C.W. Reamer (NRC) and a subsequent directive from the NRC to the Center for Nuclear Regulatory Analyses (CNWRA) in a May 10, 1999, letter from C.W. Reamer to W. Patrick. These samples derive from a past project conducted for NRC Office of Research. That project was terminated in 1995. We are unable to provide the requested water samples because they were not retained.

The box contains 10 powders and three small hand samples. (One of the powders is from the same field sample as one of the hand samples, as discussed below.) The samples were chosen on the basis of the DOE requests for rocks that plot inside the U-series "forbidden zone" and for samples that span various distances from the U mineralized zone. We have provided splits of the same powders used for alpha spectrometry except in the case of the "13 m N" East-West fracture (traverse B on the attached map). Powders from the "13 m N" fracture used in our alpha spectrometry analyses have been completely depleted; the three samples provided to the DOE in 1995 are from this same fracture.

Included with the samples are: (i) table of sample information, (ii) site map with sample traverse locations, and (iii) copies of pertinent pages from our sample custody log. The custody log pages include field grid locations, brief descriptions, and references to scientific notebook entries; copies of notebook pages are available on request. Note that the two samples with the suffix "PWD" are not explicitly in the custody log; they were prepared subsequent to the "WR1" powders that were used for our alpha analyses, and so are not splits of our alpha analysis powders.



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Mike Murrell  
May 17, 1999  
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The hand samples consist of matrix tuff and iron oxide-rich fracture filling. The hand samples are necessarily small because only a limited amount of material was available. These samples are from the same source material from which powders were prepared for alpha analyses. For sample NOPI-423, two materials are included: a "PWD" powder and a hand sample. The powder was prepared with as high a proportion of fracture fill as possible.

If you have any questions, please contact Dr. David Pickett at (210) 522-5582.

Sincerely,



English C. Percy, Element Manager  
Geohydrology & Geochemical

EP/ar

cc: W. Patrick  
CNWRA Directors  
CNWRA Element Managers  
G. Cragolino  
R. Green  
W. Murphy  
R. Pabalan  
D. Pickett  
J. Prikryl  
N. Sridhar

J. Linehan  
D. DeMarco  
B. Stiltenpole  
B. Meehan  
J. Greeves  
J. Holonich  
W. Reamer  
M. Bell  
S. Wastler  
D. Brooks

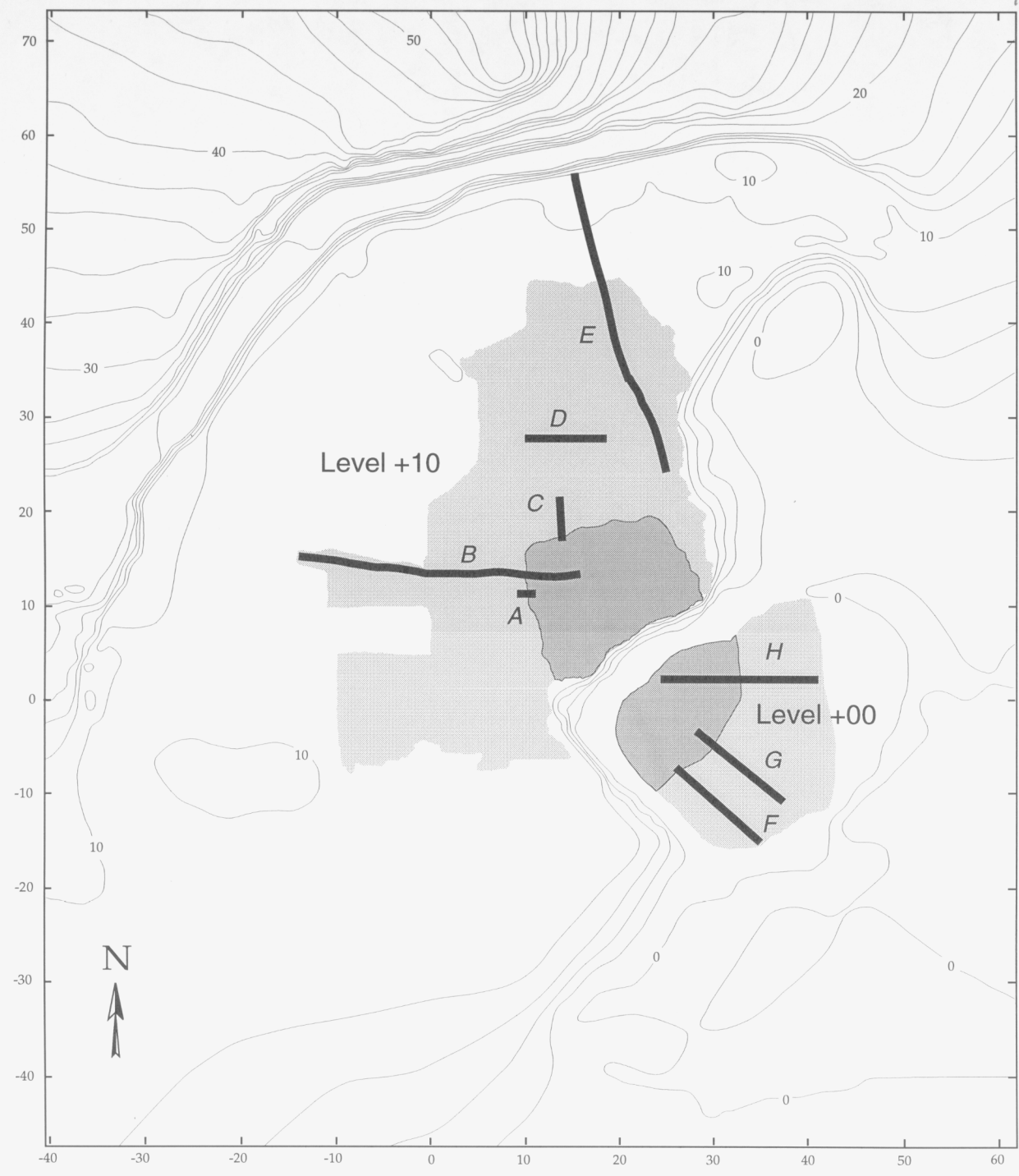
B. Leslie  
J. Ciocco  
J. Bradbury

Sample	grams	CNWRA source	Map traverse	distance from zone of visible U mineralization, meters	Sample type
NOPI-309-DOE	2	NOPI-309-WR1 powder	F	0	tuff
NOPI-320-DOE	2.1	NOPI-320-WR1 powder	F	6.8	tuff
NOPI-376-DOE	2.9	NOPI-376-WR1 powder	C	0.4	tuff
NOPI-403-DOE	1.8	NOPI-403-WR1 powder	E	14.8	fracture
NOPI-404-DOE	2	NOPI-404-WR1 powder	E	16.3	fracture
NOPI-407-DOE	1.9	NOPI-407-WR1 powder	E	22	fracture
NOPI-410-DOE	2	NOPI-410-WR1 powder	E	34.9	fracture
NOPI-411-DOE	2.1	NOPI-411-WR1 powder	E	35.9	fracture
NOPI-419-DOE	—	NOPI-419 hand sample	B	1.2	fracture/tuff
NOPI-420-DOE	1.8	NOPI-420-PWD powder	B	4	fracture
NOPI-423-DOE	—	NOPI-423 hand sample	B	12.3	fracture/tuff
NOPI-423-PWD-DOE	0.6	NOPI-423-PWD powder	B	12.3	fracture
NOPI-424-DOE	—	NOPI-424 hand sample	B	16.3	fracture/tuff

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distance in meters

NOPAL 1 SITE

Aug 10, 1999

Dr. Stephan J. Brocoum  
Assistant Manager for Licer. g  
U.S. Department of Energy  
Yucca Mountain Site Characterization Office  
P.O. Box 30307  
North Las Vegas, NV 89036-0307

cc: W. Reamer  
Director  
30/71 W. Reamer  
G. Leslie

SUBJECT: REQUEST BY THE U.S. DEPARTMENT OF ENERGY FOR SAMPLES FROM  
PEÑA BLANCA, MEXICO

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Dear Dr. Brocoum:

In your April 9, 1999, letter you requested certain samples from the Center for Nuclear Waste Regulatory Analyses (Center) for analysis by the Los Alamos National Laboratory (Los Alamos). The samples requested are from the Center's sample collection of the Nopal I uranium deposit at Peña Blanca, Mexico. We have approved your request and have requested the Center to provide Los Alamos the samples by May 14, 1999. The samples will be sent to Dr. Mike Murrell at Los Alamos. The Center staff person responsible for providing the samples you requested is Dr. David Pickett. He can be reached at (210) 522-5582 or by e-mail at dpickett@swri.edu.

We have requested that the Center provide Los Alamos with the samples and any existing documentation, either in electronic or hard copy, of the Quality Assurance documentation for the samples they send. The Center will provide, to the extent possible, splits of the powdered rock used in their uranium-series analyses. The 12 samples that will be sent are from rocks that are in the "forbidden region" and will span the distance from the mineralized zone to the furthest range of fractures. In addition, aliquots from water samples from borehole 12, and from the Level + 0 adit, will be provided to Los Alamos if sufficient water remains in the archived samples.

If you have any further questions regarding our response to your request for samples from Peña Blanca, please contact Bret Leslie of my staff at (301) 415-6652 or by e-mail at bwl@nrc.gov.

Sincerely,

Orig. Signed By:

C. William Reamer, Chief  
High-Level Waste and Performance  
Assessment Branch  
Division of Waste Management  
Office of Nuclear Material Safety  
and Safeguards

cc: see next page

**Ticket HLWB-002**

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**DOCUMENT NAME: S:\DWM\HLWB\BWL\DOEPENA.WPD**

OFC	HLWB	HLWB	HLWB		
NAME	BLeslie/eab <sup>prt</sup> y	DBrooks	CReamer		
DATE	5/10/99	5/10/99	5/10/99		

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1 ral Analogs Samples and Subsamples

Sample Id: NOPI-307 Reference: 042/138 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 23.8 Y: 25.4 Z: 10  
 Description: Fe-oxide rich vein-filling material with tuff fragments; N-S traverse  
 of a prominent fracture along NE side of orebody

Subsample Id: NOPI-307-XRD1 Reference: 080/203 Log Date: 13-JUN-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample that was prepared and analyzed  
 by XRD

Sample Id: NOPI-308 Reference: 042/122 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 26.3 Y: -7.25 Z: 0  
 Description: Broken, fractured tuff; kaolinitic with black Fe-oxides lining  
 fractures; from traverse on 0 level that runs approximately SE from  
 highly fractured tuff to weathered tuff.

Subsample Id: NOPI-308-GAM1 Reference: 080/150 Log Date: 28-MAR-94  
 Entered By: JDP Old ID:  
 Amount: 4.340 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis  
 (polypropylene vial)

Subsample Id: NOPI-308-WR1 Reference: 080/138 Log Date: 17-MAR-94  
 Entered By: JDP Old ID:  
 Amount: 14.1 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample NOPI-308

Sample Id: NOPI-309 Reference: 042/122 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 26.55 Y: -7.7 Z: 0  
 Description: Broken, fractured tuff; very Fe rich, fractures lined and filled with  
 Fe-oxide material; from traverse on 0 level that runs approximately SE  
 from highly fractured tuff to weathered tuff.

Subsample Id: NOPI-309-GAM1 Reference: 080/150 Log Date: 28-MAR-94  
 Entered By: JDP Old ID:  
 Amount: 4.202 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis  
 (polypropylene vial)

Subsample Id: NOPI-309-WR1 Reference: 080/138 Log Date: 17-MAR-94  
 Entered By: JDP Old ID:  
 Amount: 18.5 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample NOPI-309

Sample Id: NOPI-310 Reference: 042/123 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 27 Y: -8.25 Z: 0  
 Description: Broken, altered tuff; Fe-oxide rich, Fe material lines and fills  
 fractures; from traverse on 0 level that runs approximately SE from  
 highly fractured tuff to weathered tuff.





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1 ral Analogs Samples and Subsamples

Sample Id: NOPI-375 Reference: 042/134 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 17.65 Y: 14.15 Z: 10  
 Description: Broden, altered, tuff, Fe-oxide rich; collected along N/S traverse on  
 +10 level across boundary of orebody.

Subsample Id: NOPI-375-GAM1 Reference: 080/193 Log Date: 26-MAY-94  
 Entered By: JDP Old ID:  
 Amount: 3.801 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis  
 (polypropylene vial)

Subsample Id: NOPI-375-WR1 Reference: 080/159 Log Date: 12-APR-94  
 Entered By: JDP Old ID:  
 Amount: 30.5 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Sample Id: NOPI-376 Reference: 042/134 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 17.95 Y: 14.05 Z: 10  
 Description: Broden, altered, tuff, Fe-oxide (limonite) rich; collected along N/S  
 traverse on +10 level across boundary of orebody.

Subsample Id: NOPI-376-GAM1 Reference: 080/193 Log Date: 26-MAY-94  
 Entered By: JDP Old ID:  
 Amount: 3.707 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis  
 (polypropylene vial)

Subsample Id: NOPI-376-WR1 Reference: 080/160 Log Date: 12-APR-94  
 Entered By: JDP Old ID:  
 Amount: 28.7 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Sample Id: NOPI-377 Reference: 042/134 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 18.15 Y: 14 Z: 10  
 Description: Broden, altered, tuff, Fe-oxide (limonite) and kaolinite rich;  
 collected along N/S traverse on +10 level across boundary of orebody.

Subsample Id: NOPI-377-GAM1 Reference: 080/193 Log Date: 26-MAY-94  
 Entered By: JDP Old ID:  
 Amount: 3.750 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis  
 (polypropylene vial)

Subsample Id: NOPI-377-WR1 Reference: 080/183 Log Date: 06-MAY-94  
 Entered By: JDP Old ID:  
 Amount: 35.6 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Sample Id: NOPI-378 Reference: 042/134 Collection Date: 02-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 18.45 Y: 14 Z: 10  
 Description: Broden, altered, tuff, Fe-oxide (limonite) and kaolinite rich;  
 collected along N/S traverse on +10 level across boundary of orebody.

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1 Analogs Samples and Subsamples

Sample Id: NOPI-403 Reference: 042/139 Collection Date: 03-MAR-94  
Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
Old ID: Amount: Size: bulk  
X: 33.9 Y: 21.2 Z: 10  
Description: Fe-oxide fracture fill material; N-S traverse of a prominent fracture  
along NE side of orebody

Subsample Id: NOPI-403-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
Entered By: JDP Old ID:  
Amount: 3.676 g Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-403-WR1 Reference: 080/199 Log Date: 06-JUN-94  
Entered By: JDP Old ID:  
Amount: 8.8 g Size: powder Store Loc: Bldg 57  
Description: Powdered portion of bulk rock sample

Subsample Id: NOPI-403-XRD1 Reference: 080/203 Log Date: 13-JUN-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample that was prepared and analyzed  
by XRD

Sample Id: NOPI-404 Reference: 042/139 Collection Date: 03-MAR-94  
Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
Old ID: Amount: Size: bulk  
X: 35.4 Y: 20.5 Z: 10  
Description: Fe-oxide fracture fill material; N-S traverse of a prominent fracture  
along NE side of orebody

Subsample Id: NOPI-404-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
Entered By: JDP Old ID:  
Amount: 3.599 g Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-404-WR1 Reference: 080/199 Log Date: 06-JUN-94  
Entered By: JDP Old ID:  
Amount: 16.2 g Size: powder Store Loc: Bldg 57  
Description: Powdered portion of bulk rock sample

Subsample Id: NOPI-404-XRD1 Reference: 080/204 Log Date: 20-JUN-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample that was prepared and analyzed  
by XRD

Sample Id: NOPI-405 Reference: 042/140 Collection Date: 03-MAR-94  
Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
Old ID: Amount: Size: bulk  
X: 36.4 Y: 20.1 Z: 10  
Description: Fe-oxide fracture fill material, some tuff fragments; N-S traverse of  
a prominent fracture along NE side of orebody

Subsample Id: NOPI-405-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
Entered By: JDP Old ID:  
Amount: 3.826 g Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-405-WR1 Reference: 080/198 Log Date: 06-JUN-94  
Entered By: JDP Old ID:  
Amount: 14.1 g Size: powder Store Loc: Bldg 57  
Description: Powdered portion of bulk rock sample

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1 al Analogs Samples and Subsamples

Sample Id: NOPI-406 Reference: 042/140 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 38.4 Y: 19.5 Z: 10  
 Description: Tuff fragments coated with Fe-oxide rich material; N-S traverse of a prominent fracture along NE side of orebody

Subsample Id: NOPI-406-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 3.672 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-406-WR1 Reference: 080/199 Log Date: 07-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 9.8 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Subsample Id: NOPI-406-XRD1 Reference: 080/204 Log Date: 20-JUN-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample that was prepared and analyzed by XRD

Sample Id: NOPI-407 Reference: 042/140 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 41.1 Y: 18.8 Z: 10  
 Description: Fe-oxide fracture fill material, tuff fragments present; N-S traverse of a prominent fracture along NE side of orebody

Subsample Id: NOPI-407-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 3.751 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-407-WR1 Reference: 080/199 Log Date: 07-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 28.0 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Sample Id: NOPI-408 Reference: 042/140 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 43.5 Y: 18.1 Z: 10  
 Description: Mostly tuff fragments coated with Fe-oxide material; N-S traverse of a prominent fracture along NE side of orebody

Subsample Id: NOPI-408-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 3.622 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-408-WR1 Reference: 080/199 Log Date: 07-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 14.7 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Subsample Id: NOPI-408-XRD1 Reference: 080/204 Log Date: 20-JUN-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample that was prepared and analyzed by XRD

1 Analogs Samples and Subsamples

Sample Id: NOPI-409 Reference: 042/140 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 48.3 Y: 17 Z: 10  
 Description: Outside cleared area, tuff fragments coated with Fe-oxide material; N-S traverse of a prominent fracture along NE side of orebody

Subsample Id: NOPI-409-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 3.634 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-409-WR1 Reference: 080/200 Log Date: 07-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 10.3 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Sample Id: NOPI-410 Reference: 042/141 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: Y: Z: 10  
 Description: Sample taken on vertical wall of +10 level, between 22 and 23, Fe-oxide fracture fill material; N-S traverse of a prominent fracture along NE side of orebody

Subsample Id: NOPI-410-GAM1 Reference: 080/201 Log Date: 10-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 3.569 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-410-WR1 Reference: 080/200 Log Date: 07-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 11.4 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample

Subsample Id: NOPI-410-XRD1 Reference: 080/204 Log Date: 20-JUN-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample that was prepared and analyzed by XRD

Sample Id: NOPI-411 Reference: 042/141 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: Y: Z: 10  
 Description: Sample taken on vertical wall of +10 level, between 22 and 23, Fe-oxide fracture fill material; N-S traverse of a prominent fracture along NE side of orebody

Subsample Id: NOPI-411-GAM1 Reference: 080/202 Log Date: 10-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 3.794 g Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for gamma analysis

Subsample Id: NOPI-411-WR1 Reference: 080/200 Log Date: 07-JUN-94  
 Entered By: JDP Old ID:  
 Amount: 15.0 g Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of bulk rock sample



## Local Analogs Samples and Subsamples

Sample Id: NOPI-420 Reference: 042/142 Collection Date: 03-MAR-94  
Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
Old ID: Amount: 10 Size: bulk  
X: 6.2 Y: 13.95 Z: 10  
Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
13 m N; relatively undisturbed fracture fill with adjacent altered  
host tuff

Subsample Id: NOPI-420-WR1 Reference: 080/242 Log Date: 18-OCT-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Powdered portion of fracture filling material.

Subsample Id: NOPI-420-XRD2 Reference: 080/243 Log Date: 19-OCT-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample for x-ray diffraction analysis.

Sample Id: NOPI-421 Reference: 042/142 Collection Date: 03-MAR-94  
Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
Old ID: Amount: 10 Size: bulk  
X: 3.2 Y: 13.6 Z: 10  
Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
13 m N; relatively undisturbed fracture fill with adjacent altered  
host tuff

Subsample Id: NOPI-421-TS1 Reference: 080/224 Log Date: 10-AUG-94  
Entered By: JDP Old ID:  
Amount: Size: Store Loc: Bldg 57  
Description: Polished thin section prepared by Mineral Optics Laboratory.

Subsample Id: NOPI-421-WR1 Reference: 080/242 Log Date: 18-OCT-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Powdered portion of fracture filling material.

Subsample Id: NOPI-421-XRD2 Reference: 080/243 Log Date: 19-OCT-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Portion of powdered whole rock sample for x-ray diffraction analysis.

Sample Id: NOPI-422 Reference: 042/142 Collection Date: 03-MAR-94  
Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
Old ID: Amount: 10 Size: bulk  
X: 1.1 Y: 13.55 Z: 10  
Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
13 m N; relatively undisturbed fracture fill with adjacent altered  
host tuff

Subsample Id: NOPI-422-TS1 Reference: 080/224 Log Date: 10-AUG-94  
Entered By: JDP Old ID:  
Amount: Size: Store Loc: Bldg 57  
Description: Polished thin section prepared by Mineral Optics Laboratory.

Subsample Id: NOPI-422-WR1 Reference: 080/242 Log Date: 18-OCT-94  
Entered By: JDP Old ID:  
Amount: Size: powder Store Loc: Bldg 57  
Description: Powdered portion of fracture filling material.

Final Analogs Samples and Subsamples

Sample Id: NOPI-422 Reference: 042/142 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: 1.1 Y: 13.55 Z: 10  
 Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
 13 m N; relatively undisturbed fracture fill with adjacent altered  
 host tuff

Subsample Id: NOPI-422-XRD2 Reference: 080/243 Log Date: 19-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for x-ray diffraction analysis.

Sample Id: NOPI-423 Reference: 042/143 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: -2.1 Y: 14.1 Z: 10  
 Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
 13 m N; relatively undisturbed fracture fill with adjacent altered  
 host tuff

Subsample Id: NOPI-423-Jar Reference: 080/241 Log Date: 13-OCT-94  
 Entered By: JDP Old ID:  
 Amount: 1 g Size: crystals Store Loc: Bldg 57  
 Description: Mineral separate of jarosite produced by hand-picking and scraping  
 fracture fill material from host rock and heavy liquid separation.

Subsample Id: NOPI-423-TS1 Reference: 080/224 Log Date: 10-AUG-94  
 Entered By: JDP Old ID:  
 Amount: Size: Store Loc: Bldg 57  
 Description: Polished thin section prepared by Mineral Optics Laboratory.

Subsample Id: NOPI-423-WR1 Reference: 080/242 Log Date: 18-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of fracture filling material.

Subsample Id: NOPI-423-XRD2 Reference: 080/243 Log Date: 19-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for x-ray diffraction analysis.

Sample Id: NOPI-424 Reference: 042/143 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: -6.1 Y: 13.95 Z: 10  
 Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
 13 m N; relatively undisturbed fracture fill with adjacent altered  
 host tuff

Subsample Id: NOPI-424-TS1 Reference: 080/224 Log Date: 10-AUG-94  
 Entered By: JDP Old ID:  
 Amount: Size: Store Loc: Bldg 57  
 Description: Polished thin section prepared by Mineral Optics Laboratory.

Subsample Id: NOPI-424-WR1 Reference: 080/242 Log Date: 18-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of fracture filling material.

Mineral Analogs Samples and Subsamples

Sample Id: NOPI-424 Reference: 042/143 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: -6.1 Y: 13.95 Z: 10  
 Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
 13 m N; relatively undisturbed fracture fill with adjacent altered  
 host tuff

Subsample Id: NOPI-424-XRD2 Reference: 080/243 Log Date: 19-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for x-ray diffraction analysis.

Sample Id: NOPI-425 Reference: 042/143 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: -9.8 Y: 14.6 Z: 10  
 Description: Fracture fill material (Fe-rich) taken from prominent E-W fracture at  
 13 m N; relatively undisturbed fracture fill with adjacent altered  
 host tuff

Subsample Id: NOPI-425-Jar Reference: 080/215 Log Date: 20-JUL-94  
 Entered By: JDP Old ID:  
 Amount: 1 g Size: crystals Store Loc: Bldg 57  
 Description: Mineral separate of jarosite produced by hand-picking and scraping  
 fracture fill material from host rock and heavy liquid separation.

Subsample Id: NOPI-425-TS1 Reference: 080/224 Log Date: 10-AUG-94  
 Entered By: JDP Old ID:  
 Amount: Size: Store Loc: Bldg 57  
 Description: Polished thin section prepared by Mineral Optics Laboratory.

Subsample Id: NOPI-425-WR1 Reference: 080/242 Log Date: 18-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Powdered portion of fracture filling material.

Subsample Id: NOPI-425-XRD2 Reference: 080/243 Log Date: 19-OCT-94  
 Entered By: JDP Old ID:  
 Amount: Size: powder Store Loc: Bldg 57  
 Description: Portion of powdered whole rock sample for x-ray diffraction analysis.

Sample Id: NOPI-426 Reference: 042/143 Collection Date: 03-MAR-94  
 Log Date: 08-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Nopal I, Pena Blanca  
 Old ID: Amount: Size: bulk  
 X: Y: Z: 10  
 Description: Fresh Nopal tuff collected on road leading to +10 level (SW of  
 orebody) for N. Shirdar. Probably excavated from +20 level.

Sample Id: NOPI-427 Reference: 042/144 Collection Date: 03-MAR-94  
 Log Date: 07-MAR-94 Entered By: JDP Store Loc: Bldg 51 Collection Site: Pena Blanca, Nopal I  
 Old ID: Amount: Size: bulk  
 X: Y: Z:  
 Description: Nopal tuff, altered, cream-colored, float. Collected for hydrologic  
 tests.