KAWICH-A
Containment Data Report

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KAWICH-A Instrumentation Summary

Instrumentation	Fielded	Data Return	Present in this Report
<u>Plug Emplacement</u>	yes	yes	yes
<u>Radiation</u>	yes	yes	yes
<u>Pressure</u>			
Stemming	yes	yes	yes
Challenge	no	-	-
Cavity	no	-	-
Atmospheric	no	-	-
<u>Motion</u>			
Free field	no	-	-
Surface	no	-	-
Plug	no	-	-
Stemming	yes	yes	yes
Surface casing	no	-	-
Emplacement pipe	no	-	-
Recording trailer	yes	yes	yes
<u>Hydroyield</u>	no	-	-
<u>Collapse</u> (a)	yes	yes	no
<u>Stress</u>	no	-	-
<u>Strain</u> (b)	yes	yes	yes
<u>Other Measurements</u>	no	-	-

(a) EXCOR in emplacement hole.

(b) On emplacement pipe during stemming

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Contents

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1. Event Description

1.1 Containment summary

The KAWICH-A event was detonated in hole U8n of the Nevada Test Site (see figure 1.1) at 07:15 PST on December 9, 1988. No collapse was observed and no radiation above background was detected at any station. KAWICH-A containment was considered satisfactory.

1.2 Site.

A geologic map showing some of the surface features near the U8n site is shown in Figure 1.2. The device had a burial depth of 365 m in the Tub Spring Tuff under several other tuff layers and about 160 m of alluvium. The working point was about 650 m above the Paleozoic formation and 280 m above the static water level as shown in the corresponding geologic cross sections also shown in figure 1.2⁽¹⁾.

Stemming of the 3.05 m diameter emplacement hole followed the plan shown in figure 1.3. A log of the stemming operations was maintained by Holmes & Narver⁽²⁾.

1.3 Instrumentation

Figure 1.4 shows a schematic layout of the instrumentation in hole U8n, designed to monitor both the emplacement and performance of the stemming.

Emplacement of each of the six sanded gypsum concrete (SGC) plugs was monitored with thermistors and conductivity probes. Stemming performance was monitored by pressure and radiation stations between each of the six SGC plugs. Strain gauges were fielded on the emplacement pipe near its top and bottom and the pipe load was monitored as part of the device emplacement procedures.

Pressure and radiation digital data were transmitted up the hole at a rate of one sample per second per transducer using the Plug Evaluation Diagnostics (PED-III) multiplex system. An exception to this were the data from one of the two stations below the top plug: these were transmitted to the recording trailer in analog form. The sole motion transducer in the stemming column was included in this station.

A tri-axial motion station was fielded inside the recording trailer. An EXCOR sensor cable was fielded in the emplacement hole to monitor progression of the collapse front.

Brief histories of the fielding operations and instrumentation set-up are given in references 3 and 4.

Figure 1.1 Map of the Nevada Test Site indicating the location of hole U8n

Plan map for the B-B' cross section

Geologic cross section B-B' through U8n

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Figure 1.2 Geologic cross sections through hole U8n and a plan map of the local region.

Figure 1.3 As-built stemming plan for hole U8n.

Figure 1.4 As-built containment instrumentation plan for the KAWICH-A event emplacement hole U8n.

2. Emplacement

2.1 Pipe strain

The emplacement pipe was instrumented for strain with gauges on the final pipe section below the load collar (station 182) and just above the diagnostics canister (station 181). These data were taken by hand and are recorded in the Holmes & Narver stemming log (reference 2). They are also plotted in figure 2.1 along with an indication of the times when the SGC plugs were poured.

2.2 Plug levels and temperature

The emplacement of each of the six SGC plugs was monitored with conductivity and thermistor probes located as tabulated in figure 1.4. Figures 2.2–2.7 show plots of the SGC emplacement and temperature histories. In the upper plots (SGC emplacement), the upper and lower boundary positions of the plugs were measured using tag lines and reported in reference 2, solid symbols indicate the elevations of the probe stations and the open symbols indicate the elevations obtained from the tag lines. All plugs were emplaced as planned.

Figure 2.1 Load on the emplacement pipe during stemming⁽²⁾. Individual data points in the stemming log are indicated by dots on the traces.

Figure 2.2 Sanded gypsum emplacement for plug #1. Solid symbols indicate the elevations of the probes while the open symbols indicate the elevations of the SGC boundaries as given by tag lines. Probes B, D, F, and H contained temperature sensors.

Figure 2.3 Sanded gypsum emplacement for plug #2. Solid symbols indicate the elevations of the probes while the open symbols indicate the elevations of the SGC boundaries as given by tag lines. All probes contained temperature sensors.

Figure 2.4 Sanded gypsum emplacement for plug #3. Solid symbols indicate the elevations of the probes while the open symbols indicate the elevations of the SGC boundaries as given by tag lines. All probes contained temperature sensors.

Figure 2.5 Sanded gypsum emplacement for plug #4. Solid symbols indicate the elevations of the probes while the open symbols indicate the elevations of the SGC boundaries as given by tag lines. All probes contained temperature sensors.

Figure 2.6 Sanded gypsum emplacement for plug #5. Solid symbols indicate the elevations of the probes while the open symbols indicate the elevations of the SGC boundaries as given by tag lines. Probes A, C, E, and G contained temperature sensors.

Figure 2.7 Sanded gypsum emplacement for plug #6. Solid symbols indicate the elevations of the probes while the open symbols indicate the elevations of the SGC boundaries as given by tag lines. Probes A, C, E, and G contained temperature sensors.

3. Stemming Performance

3.1 Stemming pressure and radiation

As indicated in Figure 1.4, the regions between the SGC plugs were monitored by pressure and radiation stations in conjunction with a PED-III system (stations 31-132). This system transmits 12-bit data up hole at a rate of one sample per second per transducer. Signals from station 133 (a sensitive radiation and pressure station below the top plug) were transmitted to the recording trailer in analog form. All signals were recorded on magnetic tape in the recording trailer.

Pressure and radiation histories were recorded from a few minutes before detonation to about 50 minutes after detonation at which time all tape recording was terminated as there was not expected to be any further activity from the event. Figures 3.1 -3.11 show the measured pressure and radiation at each of the stemming stations. The unusual long term drift of the pressure at station 31 (figure 3.1) is unexplained. It is probably due to instrument drift or, alternatively, to the unlikely communication with an explosion-induced cavity.

3.3 Motion

Figure 3.12 shows the explosion-induced vertical motion derived from the accelerometer fielded in the coarse stemming under the top plug (station 133). Explosion-induced tri-axial acceleration of the recording trailer is shown in figure 3.13 while figure 3.14 shows the resulting first integral (tri-axial velocity). The motion level is too low to allow a meaningful second integral (displacement) to be made.

Characteristics of the motion and of the motion transducers are given in tables 3.1-3.2.

Recording was terminated before collapse phenomena (including EXCOR data) could be captured.

Figure 3.1 Pressure and radiation histories measured in the coarse stemming above SGC plug #1 (station 31 at 267 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.2 Pressure and radiation histories measured in the coarse stemming below SGC plug #2 (station 33 at 230 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.3 Pressure and radiation histories measured in the coarse stemming above SGC plug #2 (station 34 at 212 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.4 Pressure and radiation histories measured in the coarse stemming below SGC plug #3 (station 35 at 194 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.5 Pressure and radiation histories measured in the coarse stemming above SGC plug #3 (station 36 at 175 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.6 Pressure and radiation histories measured in the coarse stemming below SGC plug #4 (station 37 at 149 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.7 Pressure and radiation histories measured in the coarse stemming above SGC plug #4 (station 38 at 131 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.8 Pressure and radiation histories measured in the coarse stemming below SGC plug #5 (station 39 at 102 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.9 Pressure and radiation histories measured in the coarse stemming above SGC plug #5 (station 131 at 78 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.10 Pressure and radiation histories measured in the coarse stemming below SGC plug #6 (station 132 at 49 m depth). Data from this station were transmitted up the hole at the rate of one sample per second using the PED-III system.

Figure 3.11 Sensitive transducer pressure and radiation histories measured in the coarse stemming below SGC plug #6 (station 133 at 49 m depth). Data from this station were transmitted up the hole in analog form

Figure 3.12 Explosion-induced vertical motion of stemming below plug #6, at a depth of 49 m (station 133).

Figure 3.13 Tri-axial acceleration of the recording trailer (station 71).

Figure 3.14 Tri-axial velocity of the recording trailer (station 71).

Table 3.1 Summary of Motion

Gauge	Slant Range (m)	Arrival Time (ms)	Acceleration Peak (g)	Velocity Peak (m/s)	Displacement Peak (mm)
133av	316	168	0.53	0.043	0.5
71av	408(a)	230	0.15	0.016	(b)
71ar	408(a)	250	0.04	0.004	(b)
71at	408(a)	260	-0.06	-0.002	(b)

(a) Approximate: station is in recording trailer.

(b) Acceleration data are too low to yield this value.

Table 3.2 Accelerometer Characteristics

Gauge	Natural Frequency (Hz)	Damping Ratio	System Range (g's)
133av	1874	0.73	25
71av	325	0.65	20
71ar	325	0.65	15
71at	355	0.65	15

References

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3. William G. Webb, "Special Measurements Final Engineering Report, KAWICH-A, U8n", EG&G, Energy Measurements, Las Vegas, NV, SM:88E-158-31, 22 March 1989.
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