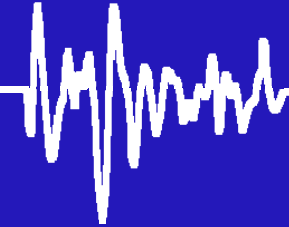


GeoSIG



The Swiss manufacturer of seismic NPP instrumentation solutions

presents

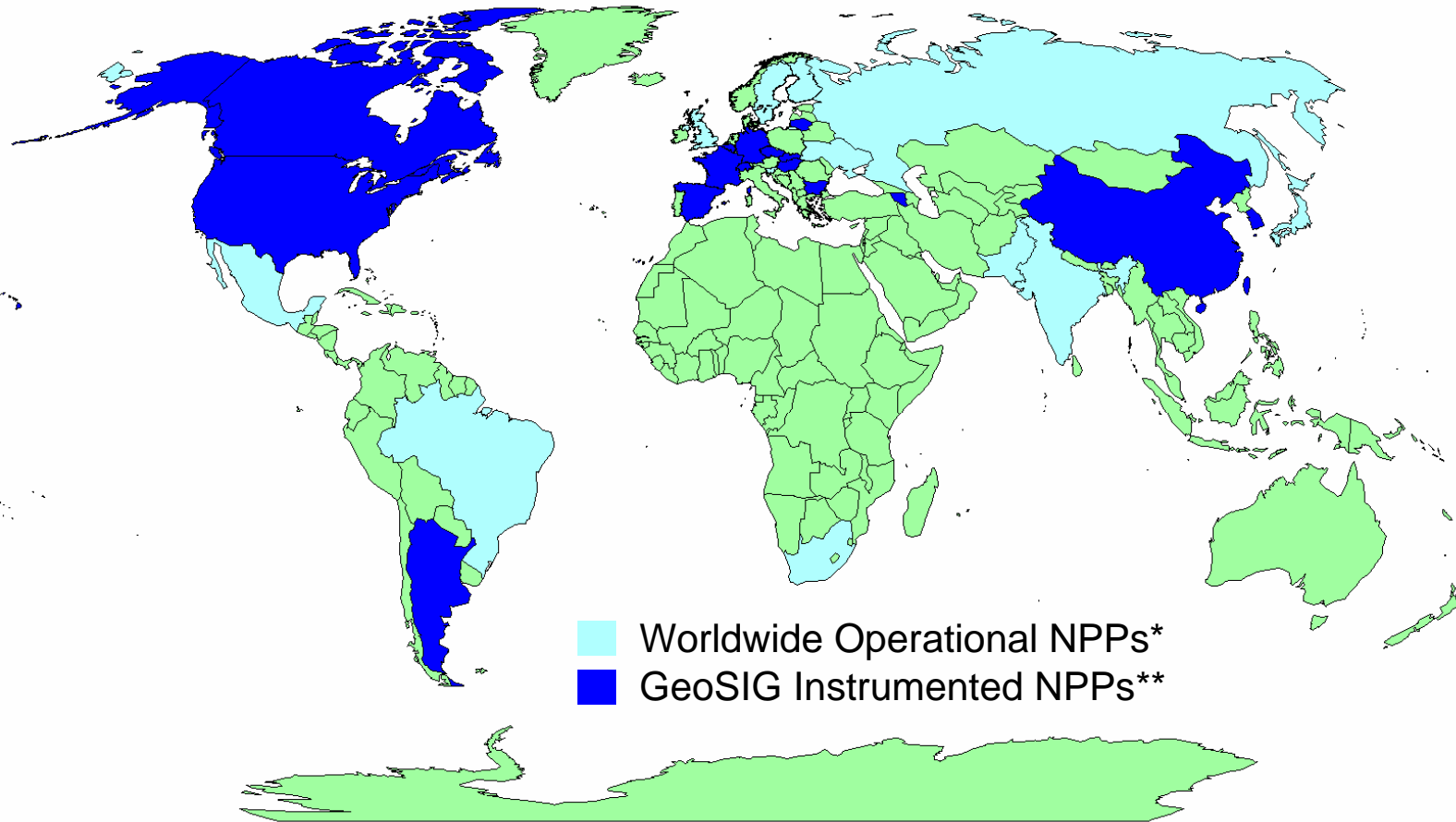
Measuring Solutions for the Nuclear Industry

Contents

- GeoSIG NPP Instrumentation in the World
- Key reference projects
- GeoSIG Equipment for NPP
- NPP Seismic Monitoring System
- Two types of system topology
- Examples of decentralized topology: Swiss NPPs
- Example of centralized topology: SMS of Susquehanna NPP
- GeoDAS Software for NPP Seismic System
- Conclusions



GeoSIG NPP Instrumentation in the World



*: data from PRIS database, 06.05.2009 (<http://www.iaea.org/cgi-bin/db.page.pl/pris.db57.htm>)

** : incl. GeoSys, SIG & Terra Technology Instruments

Key NPP Project References

NUCLEAR STATION	CUSTOMER
Beznau NPP, Unit 1 and 2, Switzerland	NOK, KKW Beznau, Switzerland
Bohunice NPP, administrative Building, Slovak Rep.	PPA, Slovak Republic
Doel NPP, Belgium	Electrabel S.A., Belgium
Embalse NPP, Argentina	NASA Nucleoelectrica Argentina SA, Argentina
Gösgen NPP, Switzerland	KKW Gösgen-Däniken AG, Switzerland
Ignalina NPP, Lithuania	INPP/PMU, Visaginas, Lithuania
Kozloduy NPP, Bulgaria	IAEA, Vienna, Austria
Leibstadt NPP, Switzerland	NOK, KKW Leistadt, Switzerland
Mochovce NPP, Unit 1 and 2, Slovak Republic	PPA, Slovak Republic
Marcoule Research Center, France	CEA / Cogema, France
Metsamor NPP, Armenia	IAEA, Vienna, Austria
PAKS NPP, Hungary	PAKSI Atomerómú RT., Hungary
PAKS NPP, Waste Disposal, Hungary	PAKSI Atomerómú RT., Hungary
Shin-Kori Unit 1-2	KEPCO, Seoul, South Korea
Temelin NPP, Czech Republic	Westinghouse Energy System, Pittsburg USA
Tianwan NPP, Unit 1 and 2, China	SNIIP Systematom, Russia
Tihange NPP, Belgium	Electrabel S.A.. Belgium
Wolsong Unit 1, original delivery + full upgrade in 2005	KEPCO, Seoul, South Korea
Wolsong Unit 2, original delivery + full upgrade in 2005	KEPCO, Seoul, South Korea
Ulchin NPP, Unit 5 and 6	KHNP, Seoul, South Korea
Zorita NPP, Spain	IIC / Spain

Supplied Equipment

GeoSIG provides the following equipment for NPPs

- **Units for integration into the monitoring and protection systems of NPPs**
- **Sensors and standalone seismic recorders**
- **Complete seismic alarm and monitoring systems**



Sensor

AC-23 Accelerometer

Full Scale Range

± 2 g (options down to ± 0.1 g)

Bandwidth

0.1 Hz to 50 or 100 Hz

Dynamic Range

> 125 dB

Axes

triaxial, biaxial, uniaxial

Downhole Version

AC-23DH



Stainless steel protection housing is available for this sensor

Recorder

GSR-18 Strong Motion Recorder

Input Range

+/- 5 V differential (default)

Bandwidth

DC - 80 Hz @ 200 SPS

Dynamic Range

> 108 dB @ 200 SPS

Power Supply

12 or 24 VDC with internal Battery (> 3 days)

Memory

512 MB standard (2 GB ~ 2 weeks recording)

Communication (serial ports)

RS-232 or RS-422



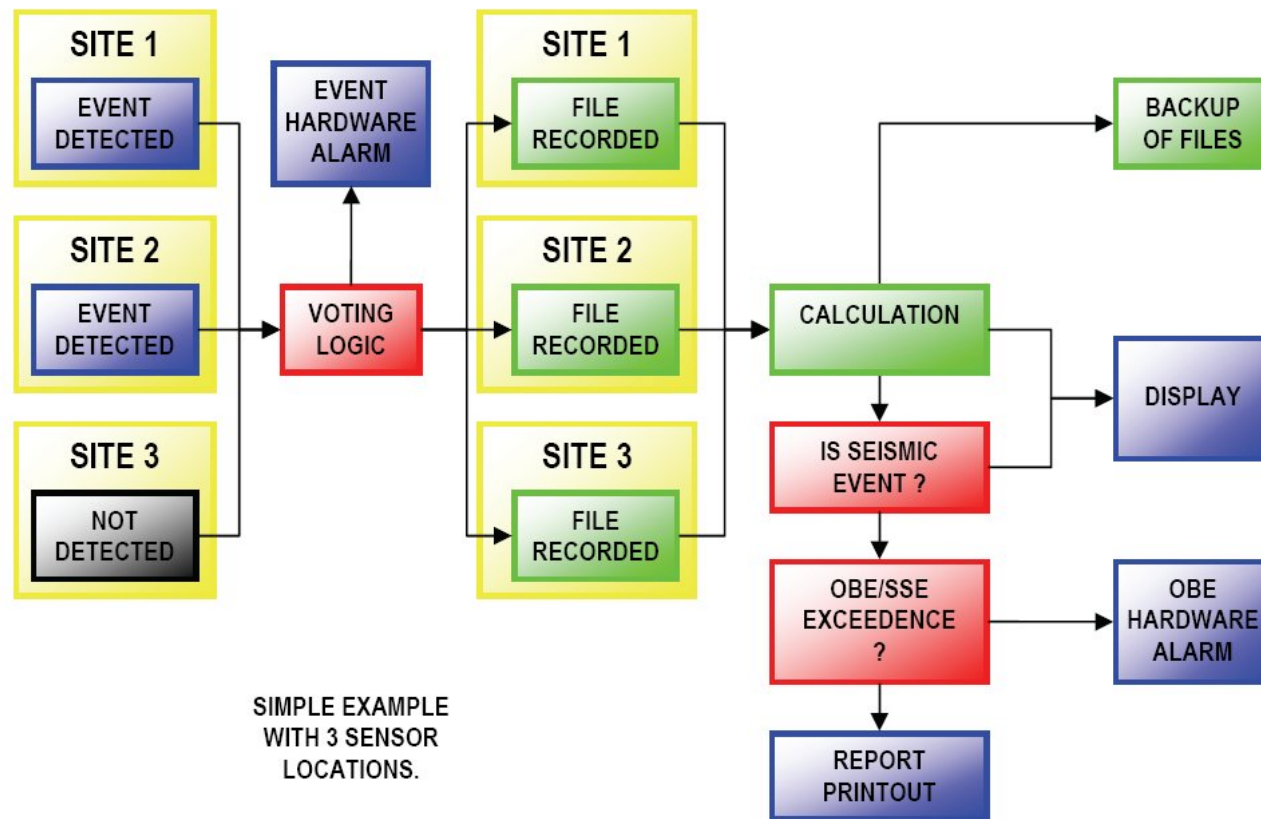
NPP Seismic Monitoring System

Summary of Features

- Use of new or existing infrastructure
- Recording, advanced analysis and annunciation according to latest or custom regulations
- Automatic RSA, RSV, CAV calculations and OBE, SSE exceedance evaluation
- Up to 48 remote stations or sensors
- 18 or 24-bit event based and/or continuous recording
- Common timing and triggering within the system
- Completely over-voltage protected
- Continuous system-wide SOH monitoring
- Reporting and alerting via visual and audible tools as well as printed matter
- Seismically and EMC proven design
- Comprehensive configuration of the whole system via the enhanced computer interface



System Functionality Diagram



Voting Logic: Automatic event alarm

Is Seismic Event: Automatic event detection (seismic yes/no)

OBE/SSE Exceedance: Automatic check for OBE and/or SSE criteria

Report Printout: Automatic printout of earthquake report

Two Types of the System Architecture



Decentralized Recording
Sensors and Recorders
at measuring locations



Centralized Recording
Sensors only
at measuring locations

System implementation: Decentralized Recording



Advantages:

Independent recording units increase redundancy and reliability.

Digital transmission between remote and central locations

Link from remote to central can use Fiber Optics (improved EM noise immunity)

System Implementation / Centralized Recording



Advantages:

Simple devices in controlled area (analog sensors).

Simplified diagnostics and maintenance.

Higher compatibility for upgrades on existing systems based on central recording topology

System Type Selection

The selection of an implementation type is usually cost driven:

For a system upgrade, the reuse of the existing cable would be a major cost reduction and would define the type of implementation.

→ Centralized in most cases

For a new system, both implementations are possible

→ Centralized or Decentralized

Decision is based on a particular site and infrastructure characteristics and conditions (specific for every plant)

Expected level of radiation at sensor site must be considered
(In Centralized implementation only the sensors are exposed in the controlled area)

EMC Qualification of SMS



GeoSIG Measuring Solutions for Nuclear Industry

SINUG Conference, June 2009

GeoSIG
www.geosig.com

Example of Decentralized System

Nuclear Power Plants in Switzerland utilize GeoSIG seismic systems with decentralized topology: Beznau, Leibstadt and Goesgen NPPs



Example of Centralized System: Susquehanna NPP

The project is done in cooperation with Nuclear Logistics – strategic partner of GeoSIG in USA for NPP market

Replacement of the old system and possibility to use existing cabling made a choice for centralized monitoring system

Equipment supplied in May 2009



Susquehanna NPP: scope of supply

Three similar systems were supplied:

- Main system: control room replacement (6 sensors)
- Training system (2 sensors)
- Simulator system



Susquehanna NPP: main functionality of SMS

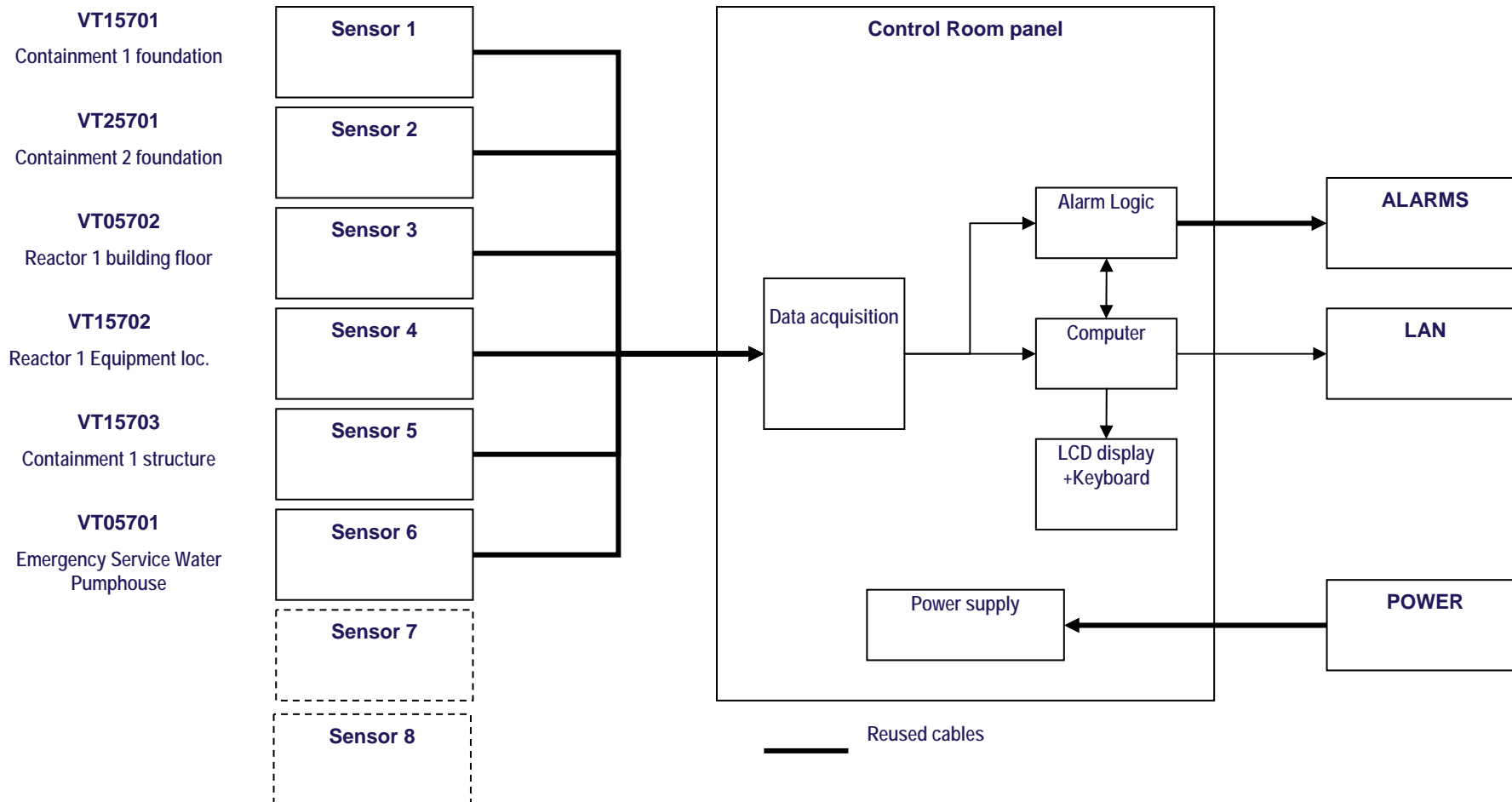
The system performs the following action and data processing during normal operation:

- Monitor correct basic operation of the system.
- Activate the COMMON ALARM in case of failure detection.
- Activate the COMMON ALARM in case of AC power loss.
- Activate the EVENT DETECTED in case of an earthquake.
- Record acceleration time history at each sensor location

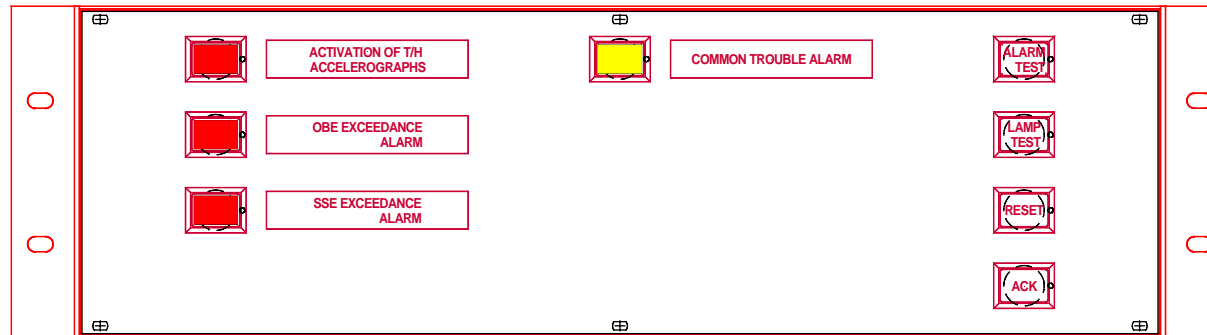
The following action and data processing are done under operator control:

- Detailed periodic test of the system.
- Calculation of Response Spectra for each channel.
- Operating Basis Earthquake (OBE) exceedance check.
- Event report generation and printing

Susquehanna NPP: SMS Block Diagram



Susquehanna NPP: SMS output signals



The available alarm outputs of the systems are:

- **AL1, seismic level 1, activation of the seismic recorder**
- **OBE Exceeded**
- **SSE Exceeded**
- **COMMON ALARM, Selftest error, self test failure, power fault, AC power is lost**

Susquehanna NPP: OBE and SSE calculations

Compliance with the Regulatory Guides:

NRC Regulatory Guide 1.12, 'Nuclear Power Plant Instrumentation For Earthquakes', Rev. 2, March 1997

NRC Regulatory Guide 1.166, 'Pre-earthquake Planning and Immediate Nuclear Power Plant Operator Post earthquake Actions', March 1997

EPRI TR-100082-T2, 'Standardization of the Cumulative Absolute Velocity', December 1991

$$\text{OBE} = (\text{RSA}_{\text{OBE}} \text{ or } \text{RSV}_{\text{OBE}}) \text{ and } \text{CAV}_{\text{OBE}}$$

$$\text{SSE} = (\text{RSA}_{\text{SSE}} \text{ or } \text{RSV}_{\text{SSE}}) \text{ and } \text{CAV}_{\text{SSE}}$$

The following parameters are used during the OBE exceedance check:

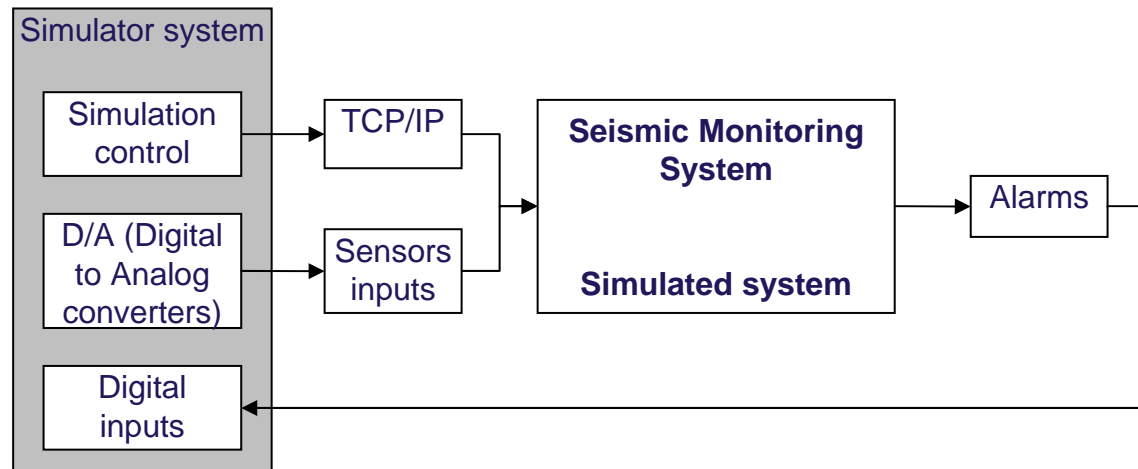
Acceleration Time History, Peak Acceleration Value.

Seismic response spectra

Cumulative Absolute Velocity

Susquehanna NPP: Simulation System

Block diagram of the Simulation System



Commands of the Simulation System

FREEZE - allow operators to observe current status of the system and to discuss it

RUN - the simulation continues at the point where it was paused or at the time defined by a RESET command.

RESET - clears the system. Any data in process will be stopped and input files cleared. The processing software on the Seismic Monitoring System is restarted and the system will be ready for processing. In addition, the RESET command can define a time that will be set to the recorder and computer when the next RUN command is issued.

GeoSIG Data Acquisition System

GeoSIG Data Acquisition System

File Edit View Analyse Settings Tools Window Help

GS256

Stations: General Information

Station	Code	Instrument	Channel Type	Status Updated	Files	Free Memory	Last Event	Voltage	Current Activity
GS009		GSR-16	Modem at COM5, +4...	Never	0 (0)	OK	No Information	DC=0.00V	Idle, not connected
GS127		GSR-18	Shared Modem, +41 79	Never	0 (0)	OK	No Information	DC=0.00V	Waiting for a channel
GS256		GSR-24	Direct Link (COM1)	Never	0 (0)	OK	No Information	DC=0.00V	Connecting...
ST001	S1_	GSR-18	Direct Link (COM2)	12.11.2004 at 16:09:09	0 (0)	13155K (85%)	No Information	AC, DC=13.03V	SOH updated

Stations: Data Streams

Station	Code	Stream Data	Instrument Time	GPS status	Trigger	DC Offset	Amplitude
GS256		3 ch 24 bit 50 sps	16:09:09	Locked	OFF	167786 83899 41956	4362089 2181051 1090532
ST001	S1_	3 ch 22 bit 100 sps	16:09:10	Not Sync	OFF	-95429 -89479 -109...	1324 3043 1429

Data Channels

Serial Communication Channels

Port	Baud	Owner	Calls In/Out	SMS In/Out	Logins	Errors	Status
COM5	38400	<GS009>	0/0	NA/NA	0	0	Failed to open
COM115	115200	Swisscom-PTT	0/0	NA/NA	0	0	Waiting for a call
COM127	115200	Swisscom-GSM	NA/0	0/0	0	0	Waiting for SMS
COM1	38400	<GS256>	NA/NA	NA/NA	0	0	Connecting...
COM2	19200	<ST001>	NA/NA	NA/NA	0	0	Receiving datastream

GeoDAS Logger

```

15.11.2004 15:04:05 COM2: Datastream reader started [1 streams]
15.11.2004 15:04:05 COM1: Data requester started: 1 streams, time cycle: 900 [GS256] ms
15.11.2004 15:04:05 COM1: Datastream reader started [1 streams]
15.11.2004 15:04:05 Data dispatcher has been started
15.11.2004 15:04:05 Station <GS256> has been added to the list of datastreams
15.11.2004 15:04:05 Station <ST001> has been added to the list of datastreams
15.11.2004 15:04:05 Station <GS009> has been added to the recorder list
15.11.2004 15:04:05 Station <GS127> has been added to the recorder list
15.11.2004 15:04:05 Station <GS256> has been added to the recorder list
15.11.2004 15:04:05 Station <ST001> has been added to the recorder list
    
```

Total: 1 Graph. Selected: 1

File: ZCH03_20040621_232500.MSD Data type: FFT Magnitude. Points: 8192, Overlapp

Peak: 7.804e-6 g at 5.51 Hz 4.625e-6

Total: 1 Graph. Selected: 1

File: ZCH03_20040621_232500.MSD Start: 21.06.2004 23:25:00.000 Length: 300.000 sec (30000 samples at 1 Station code: ZCH03

Peak: -0.01269 g at 23:25:13.629 Window RMS / PP: 0.00092 / 0.02571 g -0.00009

Peak: 0.00260 g at 23:25:14.459 Window RMS / PP: 0.00025 / 0.00530 g -0.00006

Peak: -0.00690 g at 23:25:13.280 Window RMS / PP: 0.00059 / 0.01371 g -0.00005

Logging into <GS256>... 59

OnLine: 0 OffLine: 4 GeoDAS 2.09

GeoDAS Software for NPP Seismic System

GeoDAS – GeoSIG Data Acquisition System

- Graphical Windows based application running under Windows NT4/2000/XP/Vista
- Primary GeoSIG software supporting all types of seismic instruments
- Designed to meet specific requirements of different applications
- Easy extendable and upgradeable

Main Functionality of GeoDAS in NPP applications

- Setup of instruments. One can change any parameters of an instrument with GeoDAS
- SOH monitoring. GeoDAS performs permanent or periodical monitoring of the instrument status
- Downloading of event files from the recorders
- Off-line event data view and data analysis
- Logger features. GeoDAS keeps important messages in a log file
- Analysis of the event recording files for seismic and OBE/SSE criteria
- Event check report generation, including automatic printout

Example of the main GeoDAS screen of SMS

Stationen: Allgemeine Informationen

Station	Code	Gerät	Kanaltyp	Status aktualisiert	Dateien	Freier Speicher	Letztes Ereignis	Spannung	Aktivität
ALARM	GAN	GAN	Direktverbindung (COM1)	26.08.2003 bei 18:25:19	Kein(e)	Kein Speicher	Nicht unterstützt	AC, DC=13.10V	Stationsstatus aktualisiert
F1_	F1_	GSR-18	Direktverbindung (COM3)	26.08.2003 bei 18:25:53	1 (1)	15506K (100...	26.08.2003 bei 18:11:20	AC, DC=14.15V	Aktive Verbindung
F2_	F2_	GSR-18	Direktverbindung (COM4)	26.08.2003 bei 18:25:50	1 (1)	15507K (100...	26.08.2003 bei 18:11:20	AC, DC=14.15V	Normalbetrieb
G1_	G1_	GSR-18	Direktverbindung (COM5)	26.08.2003 bei 18:25:56	1 (1)	15507K (100...	26.08.2003 bei 18:11:20	AC, DC=14.25V	Verbinden...
G2_	G2_	GSR-18	Direktverbindung (COM6)	26.08.2003 bei 18:25:53	1 (1)	15507K (100...	26.08.2003 bei 18:11:20	AC, DC=14.31V	Aktive Verbindung
G3_	G3_	GSR-18	Direktverbindung (COM7)	26.08.2003 bei 18:25:55	1 (1)	15507K (100...	26.08.2003 bei 18:11:20	AC, DC=14.15V	Aktive Verbindung
N1_	N1_	GSR-18	Direktverbindung (COM8)	26.08.2003 bei 18:25:52	1 (1)	15507K (100...	26.08.2003 bei 18:11:20	AC, DC=14.07V	Aktive Verbindung
R1_	R1_	GSR-18	Direktverbindung (COM9)	26.08.2003 bei 18:25:47	1 (1)	15507K (100...	26.08.2003 bei 18:11:20	AC, DC=14.22V	Aktive Verbindung

Resultate Ereignisprüfung

Ereignis	Seismische Prüfung				OBE Prüfung				SSE Prüfung				Bericht	
	Datum und Uhrzeit	Anz. Rec.	FFT	Dauer	Seismisch	RSA	RSV	CAV	OBE	RSA	RSV	CAV		SSE
26.08.2003 16:15:26	7/1	+	+	+	+	+	+			+	+			
26.08.2003 16:37:07	6/1	+	+	+	+	+	+							
26.08.2003 16:44:33	6/1	+	+	+	+	+	+			+				
26.08.2003 16:47:12	5/0	+												
26.08.2003 16:52:32	7/0	+												
26.08.2003 16:59:32	7/0	+												Gedruckt
26.08.2003 17:02:45	7/1	+	+		+									Gedruckt
26.08.2003 17:05:50	7/1	+	+		+									Gedruckt
26.08.2003 17:08:10	7/1	+	+		+									Gedruckt
26.08.2003 17:10:10	7/1	+	+		+			+	+	+		+	+	Gedruckt
26.08.2003 17:16:18	7/1	+	+		+									Gedruckt
26.08.2003 17:18:09	7/1	+	+		+			+	+			+		Gedruckt
26.08.2003 17:22:26	7/1	+	+		+					+			+	Gedruckt
26.08.2003 17:22:26	7/1	+	+		+					+			+	Gedruckt

Event Check parameters of GeoDAS

Event Check Parameters

Seismic Check Parameters
 An event should meet the following criteria in order to be declared seismic:

Minimum number of sites triggered:

Time frame for all triggers, sec:

Minimum duration of the event, sec:

Max frequency of the FFT peak, Hz:

OBE/SSE Check Parameters

OBE Parameters SSE Parameters

Frequency Range

RSA check range, Hz: From To

RSV check range, Hz:

Absolute Exceedance Limits

	Horizontal	Vertical
RSA limits, g	<input type="text" value="0.2"/>	<input type="text" value="0.2"/>
RSV limits, mm/s	<input type="text" value="152.4"/>	<input type="text" value="152.4"/>
CAV limits, mm/s	<input type="text" value="1500"/>	<input type="text" value="3000"/>

Parameters of Calculation

Response spectrum range, Hz:

Frequency points per decade:

CAV integration limit, g:

RSV calculation method:
 Integration in the frequency-domain
 Integration in the time-domain

Automatic Event Checks

Events recorded by the stations listed below are checked automatically for OBE and SSE

Station	Alarm	RSA Limits	RSV Limits
GSR16	Yes	test_RSA.lmf	test_RSV.lmf
GBL		test_RSA.lmf	test_RSV.lmf
GSP		test_RSA.lmf	test_RSV.lmf

Results of event checks can be forced for the test purposes:

Force to Seismic
 Force to OBE
 Force to SSE


If a station or SSE is detected and an event recorded by this station meets the OBE or SSE criteria, signals are sent to the all configured annunciators

Path to the limit files: ...

Print reports automatically for the following types of events:

GeoDAS: Annunciation Parameters and Status

Station | Instrument | Power and Batteries | Date and Time | Test | LCD Display
Communication | Errors and Warnings | Interconnection | Annunciation

 Annunciation

Status of Sites

Ch	Site	Trigger	Status	AC power	Link
1	F1	Enabled	Ok	Ok	Ok
2	G1	Disabled	Ok	Ok	Ok
3	G2	Enabled	Ok	Ok	Ok
4	K1	Disabled	Ok	Ok	Ok
5	U1	Disabled	Ok	Ok	Ok
6	R1	Disabled	Ok	Ok	Ok

Annunciator Settings

Number of stations required for common trigger:

Number of stations required for the trigger alarm:

Enable PC watchdog Timeout, minutes:

Current number of the PC watchdog timeouts:

Last timeout:

Alarms

GeoDAS: Editor of OBE/SSE Limit Files

Limit File Editor - [E:\TEMP\F2_RSA.lmf]

Table of Limits

F, Hz	OBE X	OBE Y	OBE Z	SSE X	SSE Y	SSE Z
0.100000	0.006000	0.006000	0.003750	0.012000	0.012000	0.007500
0.200000	0.022900	0.022900	0.015270	0.045810	0.045810	0.030540
0.300000	0.040960	0.040960	0.028000	0.081920	0.081920	0.056000
0.400000	0.051910	0.051910	0.035710	0.103820	0.103820	0.071420
0.500000	0.062380	0.062380	0.043130	0.124760	0.124760	0.086250
0.600000	0.072480	0.072480	0.050310	0.144970	0.144970	0.100630
0.700000	0.082290	0.082290	0.057320	0.164590	0.164590	0.114640
0.800000	0.091860	0.091860	0.064170	0.183720	0.183720	0.128340
0.900000	0.101210	0.101210	0.070890	0.202430	0.202430	0.141780
1.000000	0.110390	0.110390	0.077490	0.220780	0.220780	0.154990
1.100000	0.119400	0.119400	0.084000	0.238800	0.238800	0.167990
1.200000	0.128270	0.128270	0.090410	0.256540	0.256540	0.180920

Note: OBE and SSE limits are expected in g units for RSA and in mm/s for RSV

Damping Coefficients

X-channel Y-channel Z-channel

Buttons: Load File..., Save File, Save As..., Insert Line, Delete Line, Delete Table, Import Data..., Exit

GeoDAS: Detailed Event Check

Results of Event Checks

Event	Seismic Check				OBE Check				SSE Check				Report
Date and Time	No.Rec.	FFT	Duration	Seismic	RSA	RSV	CAV	OBE	RSA	RSV	CAV	SSE	Status
31.08.2003 05:00:50	2	+	+	+	+	+	+	+A	+	+	+	+A	Printed
22.08.2003 05:00:50	2	+	+	+	+	+	+	+A	+	+	+	+A	Printed
22.08.2003 05:00:50	2	+	+	+	+	+	+	+A	+	+	+	+A	Printed
22.08.2003 05:00:50	2	+	+	+	+	+	+	+A	+	+	+	+A	Printed

Context menu for 31.08.2003 05:00:50:

- Add Event Record...
- User Comment...
- View Graphs
- View Results
- Re-check Event
- Print Report
- Detailed Information**
 - File F2_20030831_053903.GSR recorded by <F2_>
 - File F1_20030831_053903.GSR recorded by <F1_>
- Delete Event Check Results
- Lock GeoDAS Screen

Seismic Check Results

Event date 24.04.2003, time 22:21:07. Seismic records: 1 of 2

Check Results

SEISMIC Checks	
FFT	+
Duration	+
Seismic	+
OBE Checks	
RSA	
RSV	
CAV	
OBE	
SSE Checks	
RSA	
RSV	
CAV	
SSE	

Information on Event Files

Site	File Name	Trigger Time	Result
GSR16	S2_20030424_222110.GSR	22:21:07.934	NonSEISMIC
GBD	S1_20030424_222110.GSR	22:21:08.084	OBE & SSE

Buttons: More Info, Close

Seismic Check: Detailed Information

OBE Criteria:

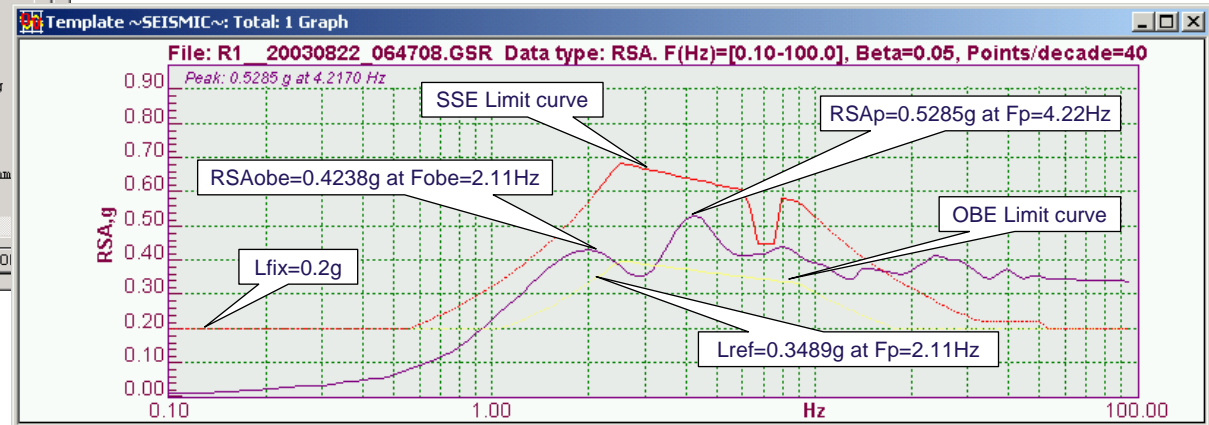
- RSA check frequency range... [2.0 - 10.0] Hz
- RSA exceeding limits..... 0.200 g (H), 0.200 g (V)
- RSA design limit file..... RF1_RSA.lmf
- RSV check frequency range... [1.0 - 2.0] Hz
- RSV exceeding limits..... 152.4 mm/s (H), 152.4 mm/s (V)
- RSV design limit file..... RF1_RSV.lmf
- CAV exceeding limits..... 1569.6 mm/s (H), 1569.6 mm/s (V)

OBE RSA Check Related Parameters:

Comp.	Fp,Hz	RSAp,g	Fobe,Hz	Lfix,g	Lref,g	RSAObe,g
X	4.22	0.5285	2.11	0.2000	0.3489	0.4238
Y	3.55	0.6863	2.11	0.2000	0.3380	0.4002
Z	2.66	0.8553	2.11	0.2000	0.2597	0.7959


OBE RSV Check Related Parameters:

Comp.	Fp,Hz	RSVp,mm/s	Fobe,Hz	Lfix,mm/s	Lref,mm/s	RSVObe,mm
X	1.50	388.6	1.00	152.4	294.1	344.3



Example of GeoDAS Event Check Report

KKW Beznau
Erdbebeninstrumentierung
Ereignisprüfung (Übersicht)



Datum Bericht: 31.08.2003
Zeit Bericht: 05:38:58 UTC

Resultat seismisch: Nein
Resultat OBE Alarm: Nein
Resultat SSE Alarm: Nein

Station	Ereignisdatei	Designspektrendatei
F1_	F1_20030831_053903.GSR	RSA:F1_RSA.lmf, RSV:F1_RSV.lmf
F2_	F2_20030831_053903.GSR	RSA:F2_RSA.lmf, RSV:F2_RSV.lmf
G1_	G1_20030831_053903.GSR	RSA:G1_RSA.lmf, RSV:G1_RSV.lmf
G2_	G2_20030831_053903.GSR	RSA:G2_RSA.lmf, RSV:G2_RSV.lmf
G3_	G3_20030831_053903.GSR	RSA:G3_RSA.lmf, RSV:G3_RSV.lmf
N1_	N1_20030831_053903.GSR	RSA:N1_RSA.lmf, RSV:N1_RSV.lmf
R1_	R1_20030831_053903.GSR	RSA:RF1_RSA.lmf, RSV:RF1_RSV.lmf

Station		Seismische Prüfung		Dauer	OBE			SSE		
		Anz. Rec.	FFT Spitze		RSA	RSV	CAV	RSA	RSV	CAV
F1_	X	Nein	14.2 Hz	0.0 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	12.2 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	13.8 Hz		Nein	Nein	Nein	Nein	Nein	Nein
F2_	X	Nein	9.4 Hz	1.2 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	13.2 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	15.8 Hz		Nein	Nein	Nein	Nein	Nein	Nein
G1_	X	Nein	16.5 Hz	0.0 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	16.5 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	16.5 Hz		Nein	Nein	Nein	Nein	Nein	Nein
G2_	X	Nein	16.5 Hz	0.0 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	16.5 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	16.5 Hz		Nein	Nein	Nein	Nein	Nein	Nein
G3_	X	Nein	16.5 Hz	0.0 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	24.9 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	24.9 Hz		Nein	Nein	Nein	Nein	Nein	Nein
N1_	X	Nein	9.1 Hz	0.0 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	16.6 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	14.0 Hz		Nein	Nein	Nein	Nein	Nein	Nein
R1_	X	Nein	9.1 Hz	0.0 s	Nein	Nein	Nein	Nein	Nein	Nein
	Y	Nein	21.5 Hz		Nein	Nein	Nein	Nein	Nein	Nein
	Z	Nein	9.0 Hz		Nein	Nein	Nein	Nein	Nein	Nein

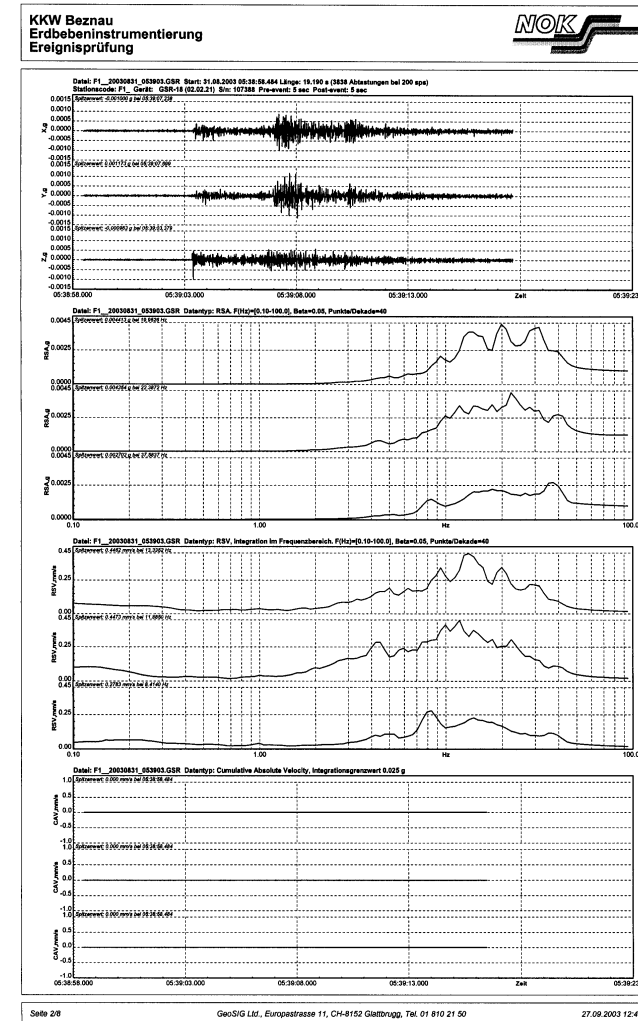
Testresultate

Station	Seismische Prüfung	OBE	SSE	OBE Alarm	SSE Alarm
F1_	Nein	Nein	Nein	Station generiert keine Alarme	
F2_	Nein	Nein	Nein	Station generiert keine Alarme	
G1_	Nein	Nein	Nein	Station generiert keine Alarme	
G2_	Nein	Nein	Nein	Station generiert keine Alarme	
G3_	Nein	Nein	Nein	Station generiert keine Alarme	
N1_	Nein	Nein	Nein	Station generiert keine Alarme	
R1_	Nein	Nein	Nein	Station generiert keine Alarme	

Kriterium seismisch	Grenzwert
Anzahl Registriergeräte	min. 1
FFT Spitzenwert	max. 33.0 Hz
Dauer	min. 2.0 s

OBE = Seismische Prüfung + (RSAobe oder RSVobe) + CAVobe
SSE = Seismische Prüfung + (RSAsse oder RSVsse) + CAVsse

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27.09.2003 12:47:17



Conclusions

- Every NPP seismic monitoring system has to fulfill user specific requirements
- During past years, GeoSIG gained excellent experience with the seismic instrumentation of three Nuclear Power Plants in Switzerland, which are all equipped with the modern Seismic Monitoring Systems manufactured by GeoSIG
- We offer two different topologies of such systems and customized measuring solutions allowing for specific requirements of any NPP and for a cost optimization
- GeoSIG has built excellent partnership relations with the Nuclear Logistics company
- As a result, we supplied first modern SMS system to the US NPP market in this year

....and we believe – more systems to come

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YOUR QUESTIONS

The End

Thank you for your attention

GeoSIG 

The Swiss manufacturer of seismic NPP instrumentation solutions