Explosives and Blasting Technique

Edited by

R. Holmberg
Dyno Nobel R&D Centre for Initiation Systems, Gnytcorp, Sweden
Swedish Rock Construction Committee, Stockholm, Sweden
Table of Contents

Foreword XI
Foreword of the President XIII
Acknowledgement XV

1. EU directives and harmonisation work

Session 1

EU directives affecting the explosives industry 5
*M. Murray & B. Hueber*

Explosion and fire hazard assessment for explosives, ammunition and fertilizing agents facilities after EU directive 96/82/EC “Seveso II”: Contribution for guidelines proposal 15
*R. Folchi*

Umsetzung der Richtlinie 93/15/EWG über das Inverkehrbringen von Explosivstoffen aus der Sicht der Herstellerindustrie und Anmerkungen zu Lagerung und Transport von Ammoniumnitrat-Emulsionen (ANE) 21
*M. Held*

Possible evolution of the blasters training in Europe 29
*M.-C. Michel*

2. Health, safety and environment, HSE

Session 2

Safety aspects of permitted explosives for use in underground coal mines 43
*R. Zimmermann*

Blasting safely and efficiently in reactive ground and/or hot ground in sulphide dust explosion generating rock 47
*P. Bellairs & Gour Sen*

Risk management and blasting operations in the demolition industry 55
*E.K. Lauritzen & J. Schneider*

Tunnelling blasting in urban and sensitive areas – risk management and consulting experiences from case histories of some Hellenic projects 61
*E. Baliktsis*

Explosives facilities – a major hazard in urban areas 73
*P. Vuillaume*

Session 3

Peak particle velocity modelling 81
*A. Wetherelt, P. Hunt & J. Pepper*
Developments in the use of scaled-distance modelling which allow an increase in the permitted charge weights while still ensuring vibration compliance

T.J. White, M. Pegden & W.J. Birch

Reducing vibration level using simulation and predictive software with EDD (ten years of history in two Lafarge quarries)

T. Bernard

Underwater blasting in Algeciras-Spain for the world biggest floating dock

H. Espinosa de los Monteros & J.A. Pascual

Traffic tunnels in rock – guide levels for blast-induced vibrations

S.-E. Johansson & G. Rundqvist

Session 4

Different evaluation criteria of permissible explosive quantity

S. Strelec, B. Bozic & M. Gazdek

Influence of different types of explosives on economical and working hygienic aspects in tunnels

V. Wetzig

Detonation characteristics of commercial ammonium nitrate prills

G. Eck, O. Machacek & K. Tallent

Modelling of consequences from accidental releases of hazardous industrial chemicals

O.J. Mika

Sprengknallreduktion durch verdämmende Materialien

T. Loose, H. Saal & H.U. Freund

3. Recent technical development – products and processes

Session 5

Evaluation of the need for electronic detonator systems for blasting operations

C.V.B. Cunningham

Electronic detonator technology in open pit mining

D.A. Bartley, R. McClure & R. Trousselle

Innovative blasting techniques for excavation of long tunnel rounds

G.W. Kuzyk, D.P. Onagi & B. Mohanty

Large size cylinder expansion tests on ANFO and gassed bulk emulsion explosives

U. Nyberg, I. Arvantidis, M. Olsson & F. Ouchterlonly

The energy balance of production blasts at Nordkalk’s Klinthagen quarry

F. Ouchterlonly, U. Nyberg, M. Olsson, I. Bergqvist, L. Granlund & H. Grind

Session 6

Temperature and pressure measurements comparison of the aluminized emulsion explosives detonation front and products expansion

S. Mencacci, A. Lefrancois, J.Y. Grouffal & P. Bouinot

A centralised digital blasting system

D. Hummel & P. Reinders

Erzeugung eines definierten Kornbandes durch GBS im Festgestein über Tage

K. Ziegler, M. Ziegler & C. Brähe

VI
Single shot drawbell blasting with Orica's i-kon® detonators at Freeport  
M.B. Lovitt & B. Jr. Degay

Session 7

Numerical modelling and evaluation of the detonation of non-ideal explosives applied to the optimisation of explosive choice for blasting operations  
Y. Bleuzen & S. Mencacci

Sulphide dust explosions in underground mines  
R.J. Enright & M. Leonte

Practical experiences and possibilities using SSE string charging system  
A. Fauske

TerrEx – terroristic expert computer model for hazard assessment in the asymmetric threat environment  
J. Pejcoch, M. Vanecek & F. Dittrich

4. Shot hole development

Session 8

Selection of inter-hole and inter-row timing for surface blasting – an approach based on burden relief analysis  
I. Onederra & S. Esen

Correlations between physical properties of PPAN and detonation characteristics of ANFO  
H. Sugihara, Y. Sato & A. Inoue

Influence of the pressure wave propagating in compressed explosives on detonator  
F. Sumiya, Y. Hirosaki & Y. Kato

The Lu-Hustrulid approach for calculating the peak particle velocity caused by blasting  
W. Lu & W. Hustrulid

Session 9

Actual benefits from new technologies related to constant timing with electronic detonators and uniform energy control  
R. Chavez & R. Chantry

Verbesserung des Sprengergebnisses und Verringerung von Erschütterungen durch Anwendung der Impulstheorie bei Gewinnungssprengungen  
B. Müller & R. Böhne

Breakage energy in rock blasting  
P. Moser, A. Grasedieck, J. du Mouza & E. Hamdi

Less fines production in aggregate and industrial minerals industry  
P. Moser

Session 10

Bottom hole and multiple power decks – independent testing results of the new blasting technique  
R.F. Chiapetta & J.L. Wyciskalla

Calculation of explosives useful work – comparison with cylinder test data  
J.A. Sanchidrián & L.M. López
Relationship of booster size and velocity of detonation in production holes
S.G. Giltner

WR-ANFO – the explosive for light and medium water conditions
A. Arczewski, J. Alin & E.C. Nygaard

Session 11
Experiences with the deconstruction of multi-hole quarry blast vibration signals
R. Farnfield, G. Yuill & W. Birch

Impulse contour of cylindrical charges without and with confinements at near distance
M. Held

Blast induced micro cracks assessment in muckpile blocks: P-wave velocity and porosity measurements
E. Hamdi, M. Audiguier, J. du Mouza & K. Fjäder

Influence of demilitarised solid propellants on detonation parameters of ammonals
K. Lipińska, M. Lipiński, A. Maranda & J. Sobala

5. Blasting experiences

Session 12
Sprengfaltung von Stahlbetonschornsteinen
R. Melzer

Sprengabbruch von zwei 150 m hohen Kühltürmen im ehemaligen Kernkraftwerk Stendal
B. Augsten & R. Melzer

The blasting of the Bernese Wankdorf stadium, August 3rd, 2001, 15:00 to 16:15 (A play in two acts)
M. Zimmermann & W. Weber

Sprengung von Stahlkonstruktionen in Deutschland – ein Bericht über 10-Jährige Erfahrungen beim Einsatz und der Handhabung von flexiblen Schneidladungen
M. Hopfe

Road tunnel in Porto: explosives or not, that was the question – a case study
J.M. Carvalho, A.T. Cavalheiro & H.B. Miranda

Session 13
Shock wave pressure in underground explosions
L.M. López, J.A. Sanchidrián, L.J. Piedra & J. Ríos

Comparison of the blast fragmentation from lab-scale and full-scale tests at Bårarp
P. Moser, M. Olsson, F. Ouchterlony & A. Grasedieck

Blast fragmentation size assessment analysis for production blasts in Indian mining conditions
N.R. Thote & D.P. Singh

The measurement and analysis of near-field pressure transients in production blasting
S. Mencacci & R. Farnfield

Real-time vibration monitoring and control on the Kamppi Center Project, Helsinki, Finland
R.A. Lee & P. Paavola

Session 14
Analysis of bench face movement in quarry blasting
P. Segarra, J.A. Sanchidrián, L.M. López, J.A. Pascual, R. Ortiz, A. Gómez & B. Smoech
Controlled blasting methods for excavating rock and concrete near critical structures
G.F. Revey

Drilling and blasting works on a highway construction on the edge of a rock-wall
S. Žganec, M. Dobrilović & Z. Ester

Blasting water-filled concrete structures
G. Berta & G. Ottelli

Session 15

Lake tap blast for salmon fishery improvement
J.R. Wallace

Design of the final wall blasting for the Croatian motorway project
R. Pisk, D. Vrkljan & Z. Ester

Dynamic influence of blasting on primary and secondary tunnel support system
Z. Ester, M. Dobrilović & D. Vrkljan

Session 16

The “Big Bang” at Tucurui – the blasting of the 300 m long downstream cofferdam in Canal II
K. Kure, C. Herweg & G.A. Mellios

Comparison of the tunnel boring machine and blasting excavation methods at Cappadocian tuff (Turkey), based on efficiency, safety and costs
C. Agan

Unexploded ordnance and the Kokkola 13 m Channel in Finland
H.F. Tomperi

Optimal parameters of blasting in tunnels using cartridge and pumped explosives with electric and non-electric initiation
Z. Deković, Z. Ester & M. Dobrilović

Session 17

Spaltsprengungen am Widerlager West des Wasserstrassenkreuzes Magdeburg
M. Schumann

Improving slope stability with electronic delays
J.L. Floyd

Effect of blast design on crack response
C.H. Dowding, C. Aimone-Martin & M.L. Snider

Predictability and prediction of ground vibrations in demolition blasting
R. Mancini, M. Cardu & E. Michelotti

6. Management of blasting operations

Session 18

Technical conditions, directions and priorities for blast technology development in Russia
V.A. Belin & A.F. Avdeev

Use of neural networks to assess economical influence and predict blasting fragmentation
J. Schleifer & D. Nourry
Electronic blasting and blast management
F. Hammelmann & P. Reinders

Determination of most active rock mass heterogeneity on blast: their use in an experimental design based on statistical process control
A.C. Sauvage & A. Blanchier

Session 19

An intelligence-expert system for bench blasting design and its application at the Lanjian iron mine
J.C. Zhang, S.Y. Zheng & C. Chang

Future development of neural network prediction for blast design parameters of production blasting
V. Petr, M.G. Simões & T.G. Rozgonoyi

Author index