



# Bergvesenet

Postboks 3021, 7002 Trondheim

## Rapportarkivet

|                                                                                                                               |                          |                              |                                   |                               |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------|-----------------------------------|-------------------------------|
| Bergvesenet rapport nr<br><b>BV 1350</b>                                                                                      | Intern Journal nr        | Internt arkiv nr             | Rapport lokalisering<br>Trondheim | Gradering<br><b>Fortrolig</b> |
| Kommer fra ..arkiv                                                                                                            | Ekstern rapport nr       | Oversendt fra<br>Norsk Hydro | Fortrolig pga<br>Utmål            | Fortrolig fra dato:           |
| Tittel<br>Sampling programme at the old Ertelien Nickel Mine, Ringerike, Norway                                               |                          |                              |                                   |                               |
| Forfatter<br>Gammon, John B.                                                                                                  |                          | Dato<br>Febr 1972            | Bedrift<br>Sulfidmalm A/S         |                               |
| Kommune<br>Ringerike                                                                                                          | Fylke<br>Buskerud        | Bergdistrikt<br>Østlandske   | 1: 50 000 kartblad<br>18153       | 1: 250 000 kartblad<br>Hamar  |
| Fagområde<br>Geokjemi                                                                                                         | Dokument type<br>Rapport |                              | Forekomster<br>Ertelien           |                               |
| Råstofftype<br>Malm/metall                                                                                                    | Emneord<br>Ni Cu         |                              |                                   |                               |
| Sammendrag<br>Det er et 2 siders notat.<br><br>Det ligger med et <b>geologisk</b> kart over Ertelien gruve med prøvepunktene. |                          |                              |                                   |                               |

Denne samarbeidsrapport mottatt i ett ekpl. fra Sulfidmalen 23.2.72.  
Kopi tas av rapport + map for Steinar Trålbak.

BV 1350

Trålbak

| Tit            | T. & F-etat      | Seit  | Eksp. |
|----------------|------------------|-------|-------|
|                | Plan             |       |       |
|                | Frank            |       |       |
|                | Bygn.svd.        |       |       |
|                | Elektro/instr.   |       |       |
|                | Engineering      |       |       |
|                | Extern Eng.      |       |       |
|                | Konstr.          |       |       |
|                | Mekanisk         |       |       |
|                | Miljøvern        |       |       |
|                | Planlegging      |       |       |
|                | Pres. tekn.      |       |       |
| X              | Pres. klaring    |       |       |
|                | Tekn. bist. etc. |       |       |
|                | Tekn. sekr.      |       |       |
| Besvart (dato) |                  | Sign. |       |

FOR:

FALCONBRIDGE NIKKELVERK A/S

NORSK HYDRO A/S

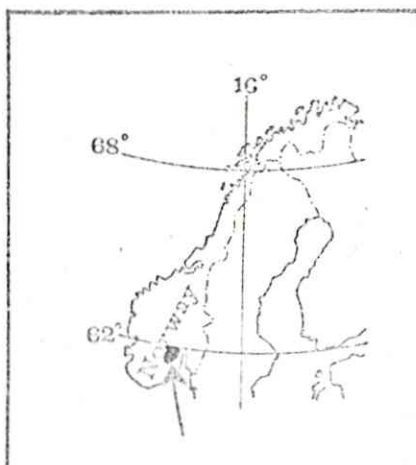
A/S SULFIDMALM

PROJECT 905-15

SAMPLING PROGRAMME AT THE OLD  
ERTELIEN NICKEL MINE, RINGERIKE,  
NORWAY.

J.B. Garmon

February 1972



7 + 9

## INTRODUCTION

At a meeting of representatives of Norsk Hydro A/S and A/S Sulfidmalm on 27th May 1971 it was agreed that the low grade-large tonnage potential of the Ertelien nickel mine in Ringsrike should be evaluated.

## SAMPLING METHOD

The geological map of Ertelien at a scale of 1:1000 prepared by Overwien and Charteris in 1963 was used as a basis for the sampling. Three profiles were sampled, these were placed so as to cover the areas mapped as gabbro containing disseminated sulphides. Sample locations were based on available outcrops in the vicinity of the three profiles.

(by all people) Sampling was carried out by using compressed air and gasoline driven percussion drills. The drilling was done through a hole in the base of a plastic bucket which was used to collect the powder resulting from the drilling.

## ASSAYING

The 71 resulting samples were assayed by Norsk Hydro for S, Co, Ni and Cu. The assay results and sample locations are shown on the attached map. The metals were analysed by atomic absorption after extraction in 1:1 nitric acid. Sulphur was determined gravimetrically after extraction with sodium peroxide.

Ten of the samples were split and assayed by Falconbridge Nikkelverk A/S in Kristiansand for S, Co, Ni, Cu and Fe.

The method used for Ni, Cu and Co was atomic absorption on samples extracted in concentrated  $\text{HNO}_3$  (40 ml), perchloric acid (10 ml) and hydrofluoric acid (2-3 ml). Sulphur was determined by X-ray using standard curves, controlled by gravimetric assay results. Iron was determined by X-ray of the solution used in the Ni-Cu-Co analyses.

...../2

A) Sammenligning Röntgenfluorescens (Frauchen ved PF har 9 år gammel analyse; - kr. sand skal være bra fått et 3kw lett maskiner. By Norsk stid (Tromsø).  
1- 10% H-kon. 2- 10% H-kon. 3- 10% H-kon. 4- 10% H-kon. 5- 10% H-kon. 6- 10% H-kon. 7- 10% H-kon. 8- 10% H-kon. 9- 10% H-kon. 10- 10% H-kon.

The attached (Fig. 1) graph shows a comparison of the S - Cu - Ni assays by the two labs. Correlation for copper and nickel is very good. The Falconbridge results are consistently slightly higher than Hydro's. This probably reflects the much stronger extraction method.

The majority of the sulphur assays correlate well. In two cases Hydro's results are much higher than Falconbridge's and in one case much lower. Fig. 2 shows the same data plotted as sulphur vs. nickel. Most of the results fall within the indicated band which presumably reflects a Ni: S ratio for the Ertelien ores. Three points fall well outside this band. These are the same three which gave a poor correlation for sulphur. This would suggest, but does not prove, that the Hydro sulphur assays are suspect in these three cases.

#### RESULTS

The attached map shows the sampling results. All samples on Profile III gave low results, all except one being less than 0.1% Ni. Profile II crosses the area of the main workings, all samples collected from gabbro except two contain more than 0.1% Ni and one sample, close to the old open pit, contains more than 0.2% Ni. On profile I the values are low, less than 50% having more than 0.1% Ni.

#### CONCLUSIONS

The results have convincingly shown that disseminated mineralization contains below ore grade values in those areas of the Ertelien gabbro available for sampling. No encouragement is given for further work along these lines. The nickel sulphur ratio of these low grade samples agrees quite well with earlier reported values of 3.0% nickel in pure sulphides. Such a low grade concentrate value is a discouraging feature in looking for new massive ore lenses.

  
J. S. Gammon

Assay result from drill samples.

NORSK HYDRO %  
% S % Co % Ni % Cu  
% S % Co % Ni % Cu % Fe

Profile I

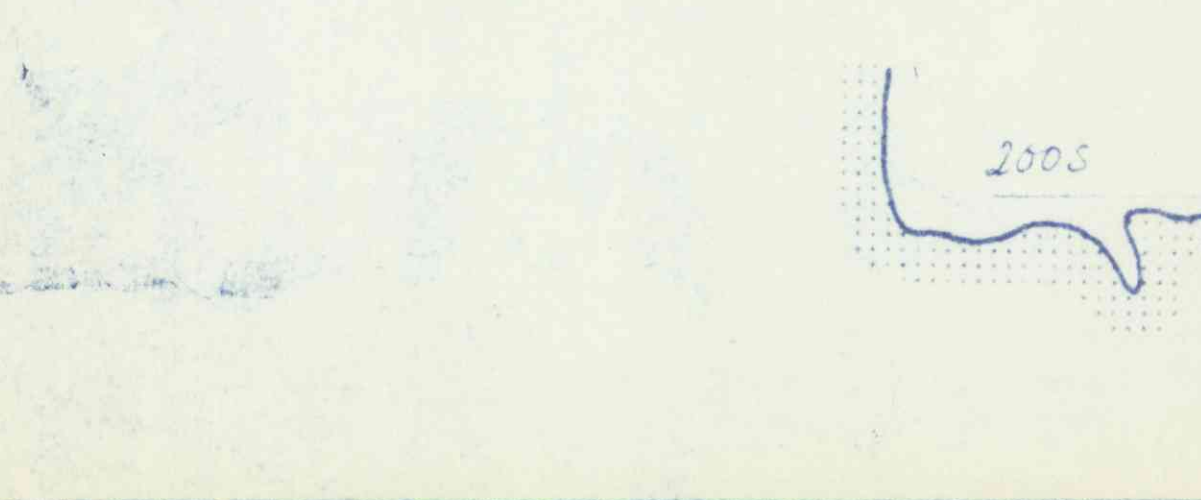
|            |     |       |       |       |      |                      |
|------------|-----|-------|-------|-------|------|----------------------|
| Drill hole | 0   | 0.2   | <0.01 | <0.01 | 0.01 |                      |
| 1          | 0.4 | <0.01 | <0.01 | 0.01  |      |                      |
| 2          | 0.3 | <0.01 | <0.01 | 0.01  |      |                      |
| 3          | 3.4 | 0.01  | 0.14  | 0.07  | 2.3  | 0.015 0.4 0.10 10.5  |
| 4          | 1.7 | <0.01 | 0.11  | 0.08  | 1.7  | 0.009 0.13 0.11 10.0 |
| 5          | 1.6 | <0.01 | 0.13  | 0.07  | 1.3  | 0.009 0.14 0.10 1.3  |
| 6          | 2.6 | 0.01  | 0.19  | 0.13  | 2.4  | 0.006 0.21 0.16 11.4 |
| 7          | 1.2 | <0.01 | 0.08  | 0.06  |      |                      |
| 8          | 0.3 | <0.01 | 0.07  | 0.02  |      |                      |
| 9          | 2.0 | 0.01  | 0.14  | 0.10  |      |                      |
| 10         | 0.7 | <0.01 | 0.05  | 0.04  |      |                      |
| 11         | 0.2 | <0.01 | 0.02  | 0.01  |      |                      |
| 12         | 0.3 | <0.01 | 0.04  | 0.02  |      |                      |
| 13         | 0.2 | <0.01 | 0.02  | 0.01  |      |                      |
| 14         | 0.2 | <0.01 | 0.02  | 0.01  |      |                      |
| 15         | 1.5 | 0.01  | 0.12  | 0.08  |      |                      |
| 16         | 0.9 | <0.01 | 0.08  | 0.05  |      |                      |
| 17         | 0.3 | <0.01 | 0.03  | 0.01  |      |                      |
| 18         | 1.9 | 0.01  | 0.07  | 0.04  |      |                      |
| 19         | 2.3 | 0.01  | 0.07  | 0.05  |      |                      |
| 20         | 0.2 | <0.01 | 0.03  | 0.01  |      |                      |
| 21         | 0.5 | <0.01 | 0.06  | 0.03  |      |                      |
| 22         | 1.4 | 0.01  | 0.14  | 0.09  |      |                      |
| 23         | 2.3 | 0.01  | 0.19  | 0.14  | 2.5  | 0.01 0.20 0.15 8.9   |
| 24         | 0.2 | <0.01 | 0.03  | 0.01  |      |                      |
| 25         | 0.1 | <0.01 | 0.02  | 0.01  |      |                      |

Profile II

|            |     |       |       |       |      |                      |
|------------|-----|-------|-------|-------|------|----------------------|
| Drill hole | 1   | 0.8   | <0.01 | 0.0   | 0.06 |                      |
| 2          | 1.2 | <0.01 | 0.12  | 0.06  |      |                      |
| 3          | 3.2 | 0.02  | 0.24  | 0.10  | 3.0  | 0.009 0.23 0.13 10.0 |
| 4          | 1.2 | 0.01  | 0.12  | 0.06  |      |                      |
| 5          | 2.0 | 0.01  | 0.17  | 0.09  | 2.0  | 0.003 0.17 0.11 9.6  |
| 6          | 1.8 | 0.01  | 0.11  | 0.07  |      |                      |
| 7          | 0.9 | <0.01 | 0.07  | 0.04  |      |                      |
| 8          | 0.9 | <0.01 | 0.08  | 0.05  |      |                      |
| 9          | 1.9 | 0.01  | 0.12  | 0.08  |      |                      |
| 10         | 2.1 | 0.01  | 0.11  | 0.09  |      |                      |
| 11         | 0.3 | <0.01 | 0.06  | 0.02  |      |                      |
| 12         | 1.4 | 0.01  | 0.12  | 0.07  |      |                      |
| 13         | 1.7 | 0.01  | 0.11  | 0.07  |      |                      |
| 14         | 1.7 | 0.01  | 0.12  | 0.14  |      |                      |
| 15         | 2.1 | 0.01  | 0.13  | 0.09  |      |                      |
| 16         | 0.1 | <0.01 | <0.01 | <0.01 |      |                      |
| 17         | 0.1 | <0.01 | <0.01 | <0.01 |      |                      |
| 18         | 0.1 | <0.01 | 0.01  | <0.01 |      |                      |
| 19         | 0.2 | <0.01 | 0.01  | <0.01 |      |                      |
| 20         | 0.1 | <0.01 | 0.01  | <0.01 |      |                      |
| 21         | 0.1 | <0.01 | 0.01  | <0.01 |      |                      |
| 22         | 2.1 | 0.01  | 0.17  | 0.11  |      |                      |
| 23         | 1.9 | 0.01  | 0.18  | 0.12  |      |                      |
| 24         | 1.0 | <0.01 | 0.10  | 0.08  |      |                      |
| 25         | 1.2 | 0.01  | 0.15  | 0.10  |      |                      |
| 26         | 1.9 | 0.01  | 0.15  | 0.13  |      |                      |
| 27         | 1.8 | 0.01  | 0.13  | 0.13  |      |                      |
| 28         | 2.5 | 0.02  | 0.24  | 0.14  | 2.2  | 0.04 0.25 0.16 9.5   |

Profile III

|            |     |       |       |       |      |                     |
|------------|-----|-------|-------|-------|------|---------------------|
| Drill hole | 1   | 0.6   | <0.01 | 0.01  | 0.02 |                     |
| 2          | 0.7 | <0.01 | 0.05  | 0.04  |      |                     |
| 3          | 0.1 | <0.01 | 0.02  | 0.04  |      |                     |
| 4          | 0.2 | <0.01 | 0.04  | 0.02  |      |                     |
| 5          | 0.3 | <0.01 | 0.09  | 0.07  | 1.7  | 0.004 0.10 0.09 7.8 |
| 6          | 1.5 | <0.01 | 0.08  | 0.07  |      |                     |
| 7          | 1.7 | <0.01 | 0.05  | 0.04  |      |                     |
| 8          | 0.6 | <0.01 | 0.07  | 0.05  |      |                     |
| 9          | 1.0 | <0.01 | 0.11  | 0.08  | 1.4  | 0.002 0.13 0.10 9.8 |
| 10         | 1.6 | <0.01 | 0.01  | <0.01 |      |                     |
| 11         | 0.2 | <0.01 | 0.03  | 0.02  |      |                     |
| 12         | 0.2 | <0.01 | 0.01  | <0.01 |      |                     |
| 13         | 0.2 | <0.01 | <0.01 | <0.01 |      |                     |
| 14         | 0.1 | <0.01 | <0.01 | <0.01 |      |                     |
| 15         | 0.2 | <0.01 | <0.01 | <0.01 |      |                     |
| 16         | 0.2 | <0.01 | <0.01 | <0.01 |      |                     |
| 17         | 0.2 | <0.01 | <0.01 | <0.01 |      |                     |



- LEGEND
- Pyromorphite
  - Sulphides - disseminated and massive
  - Dark green gneiss
  - Silicified gabbro
  - Gabbro and related phases
  - Gneiss
  - Shaft
  - Building
  - Road
  - Stream
  - Waste rock dump

|                                                         |       |             |      |
|---------------------------------------------------------|-------|-------------|------|
| ROCK SAMPLE ASSAYS<br>ERTELIEN MINE<br>RINGERIKE NORWAY | SCALE | OBS. Hydro  | 7.71 |
|                                                         |       | DRAW. Hydro | 9.71 |
|                                                         |       | TRAC. U.T.  | 2.72 |
|                                                         |       | CHS. J.G.   | 2.72 |
| MAP NO.                                                 |       |             |      |
| MAP SHEET                                               |       |             |      |

# Analyseresultater fra prøveboring:

## Profil I.

| Borhull | % S | % Co   | % Ni   | % Cu |
|---------|-----|--------|--------|------|
| 0       | 0.2 | < 0.01 | < 0.01 | 0.01 |
| 1       | 0.4 | < 0.01 | < 0.01 | 0.01 |
| 2       | 0.3 | < 0.01 | < 0.01 | 0.01 |
| 3       | 3.4 | 0.01   | 0.14   | 0.07 |
| 4       | 1.7 | < 0.01 | 0.11   | 0.08 |
| 5       | 1.6 | < 0.01 | 0.13   | 0.07 |
| 6       | 2.6 | 0.01   | 0.19   | 0.13 |
| 7       | 1.2 | < 0.01 | 0.08   | 0.06 |
| 8       | 0.3 | < 0.01 | 0.07   | 0.02 |
| 9       | 2.0 | 0.01   | 0.14   | 0.10 |
| 10      | 0.7 | < 0.01 | 0.05   | 0.04 |
| 11      | 0.2 | < 0.01 | 0.02   | 0.01 |
| 12      | 0.3 | < 0.01 | 0.04   | 0.02 |
| 13      | 0.2 | < 0.01 | 0.02   | 0.01 |
| 14      | 0.2 | < 0.01 | 0.02   | 0.01 |
| 15      | 1.5 | 0.01   | 0.12   | 0.08 |
| 16      | 0.9 | < 0.01 | 0.08   | 0.05 |
| 17      | 0.3 | < 0.01 | 0.03   | 0.01 |
| 18      | 1.9 | 0.01   | 0.07   | 0.04 |
| 19      | 2.3 | 0.01   | 0.07   | 0.05 |
| 20      | 0.2 | < 0.01 | 0.03   | 0.01 |
| 21      | 0.5 | < 0.01 | 0.06   | 0.03 |
| 22      | 1.3 | 0.01   | 0.14   | 0.09 |
| 23      | 2.3 | 0.01   | 0.19   | 0.14 |
| 24      | 0.2 | < 0.01 | 0.03   | 0.01 |
| 25      | 0.1 | < 0.01 | 0.02   | 0.01 |

Totalanalyse  
46 Substanser

| Ni | Fe   | Cu    | F    | S    |
|----|------|-------|------|------|
| 3  | 0.14 | 0.015 | 0.10 | 1.05 |
| 4  | 0.23 | 0.009 | 0.11 | 1.0  |
| 5  | 0.14 | 0.009 | 0.10 | 1.0  |
| 6  | 0.21 | 0.015 | 0.16 | 1.4  |

Kvantitativ bestemmelse av svovl, kobolt, nikkel og kobber i 71 bueprøver fra Ertelien.

Analysemetoder:

Kobolt, nikkel og kobber er bestemt v.h.a. atomabsorpsjon eller oppløsning av prøven med HNO<sub>3</sub> (1:1). Svovl er bestemt gravimetrisk eller oppløsning av prøven med natriumpersulfat.

## Profil II.

| Borhull | % S | % Co   | % Ni   | % Cu   |
|---------|-----|--------|--------|--------|
| 1       | 0.8 | < 0.01 | 0.12   | 0.06   |
| 2       | 1.2 | < 0.01 | 0.15   | 0.06   |
| 3       | 3.7 | 0.02   | 0.24   | 0.10   |
| 4       | 1.2 | 0.01   | 0.12   | 0.06   |
| 5       | 2.0 | 0.01   | 0.17   | 0.09   |
| 6       | 1.8 | 0.01   | 0.11   | 0.07   |
| 7       | 0.9 | < 0.01 | 0.07   | 0.04   |
| 8       | 0.9 | < 0.01 | 0.08   | 0.05   |
| 9       | 1.9 | 0.01   | 0.12   | 0.08   |
| 10      | 2.1 | 0.01   | 0.11   | 0.09   |
| 11      | 0.3 | < 0.01 | 0.06   | 0.02   |
| 12      | 1.4 | 0.01   | 0.12   | 0.07   |
| 13      | 1.7 | 0.01   | 0.11   | 0.07   |
| 14      | 1.7 | 0.07   | 0.12   | 0.14   |
| 15      | 2.1 | 0.01   | 0.13   | 0.09   |
| 16      | 0.1 | < 0.01 | < 0.01 | < 0.01 |
| 17      | 0.1 | < 0.01 | < 0.01 | < 0.01 |
| 18      | 0.1 | < 0.01 | < 0.01 | < 0.01 |
| 19      | 0.2 | < 0.01 | < 0.01 | < 0.01 |
| 20      | 0.1 | < 0.01 | < 0.01 | < 0.01 |
| 21      | 0.1 | < 0.01 | < 0.01 | < 0.01 |
| 22      | 2.1 | 0.01   | 0.14   | 0.11   |
| 23      | 1.9 | 0.01   | 0.18   | 0.12   |
| 24      | 1.0 | < 0.01 | 0.10   | 0.08   |
| 25      | 1.2 | 0.01   | 0.10   | 0.09   |
| 26      | 1.9 | 0.01   | 0.15   | 0.10   |
| 27      | 1.8 | 0.01   | 0.15   | 0.13   |
| 28      | 2.5 | 0.02   | 0.24   | 0.14   |

14/5 = 0.88% N

## Profil III.

| Borhull | % S | % Co   | % Ni   | % Cu   |
|---------|-----|--------|--------|--------|
| 1       | 0.4 | < 0.01 | 0.01   | 0.02   |
| 2       | 0.7 | < 0.01 | 0.05   | 0.04   |
| 3       | 0.1 | < 0.01 | 0.02   | 0.04   |
| 4       | 0.2 | < 0.01 | 0.04   | 0.02   |
| 5       | 0.3 | < 0.01 | 0.09   | 0.07   |
| 6       | 1.5 | < 0.01 | 0.08   | 0.07   |
| 7       | 1.7 | < 0.01 | 0.05   | 0.04   |
| 8       | 0.6 | < 0.01 | 0.07   | 0.05   |
| 9       | 1.0 | < 0.01 | 0.11   | 0.08   |
| 10      | 1.6 | < 0.01 | 0.01   | < 0.01 |
| 11      | 0.2 | < 0.01 | 0.03   | 0.02   |
| 12      | 0.2 | < 0.01 | 0.01   | < 0.01 |
| 13      | 0.2 | < 0.01 | < 0.01 | < 0.01 |
| 14      | 0.1 | < 0.01 | < 0.01 | < 0.01 |
| 15      | 0.2 | < 0.01 | < 0.01 | < 0.01 |
| 16      | 0.2 | < 0.01 | < 0.01 | < 0.01 |
| 17      | 0.2 | < 0.01 | < 0.01 | < 0.01 |

11/56 = 0.19% N

2. Nam "stase"

S. uoverensstemmelse

Kant: Lide N;

i s. likhet.

11/56 = 0.19% N

|    |      |     |
|----|------|-----|
| 13 | 0.08 | 185 |
| 22 | 0.13 | 285 |
| 56 | 0.26 | 56  |

52.56 = 0.1% N



Styrtning 0.1-0.14% N  
sett av ang 0.2-0.24% N  
4.11.77  
JH

Tilførsel brokper for  
Woodstock, av best  
for Porsgrunn Fabrikker (JH/MN)  
det 3.11.77.  
At als sveigedalen.  
Tegnet etter E. Overvins rask.  
(Individuelt %)

|                             |  |                                                  |          |                  |                                                                             |           |                                                                               |           |
|-----------------------------|--|--------------------------------------------------|----------|------------------|-----------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------|-----------|
| Bestilling                  |  | Ant. pr. enhet                                   | Pos. nr. | Navn, type, dim. | Tegning Standard                                                            | Materiale | Mto. vekt kg/stk.                                                             | Lagernorm |
| Dato/Sig.                   |  | Toleranse for ikke spesielt toleranse-satte mål. |          | Ann.             | Materiålbetegnelse etter DIN 17006, 17100, 17440 hvor ikke annet er angitt. |           | Denne tegning er vår eiendom og må ikke kopieres eller forevises ureddekomme. |           |
| Dato                        |  | Konstr./tegn.                                    |          | Sett             | Målestokk 1:1000                                                            |           | Proj. met.                                                                    |           |
| Godkj.                      |  | 1                                                |          | 2                | 3                                                                           | 4         |                                                                               |           |
| ERTELIEN GRUBER, RINGERIKE. |  |                                                  |          |                  |                                                                             |           |                                                                               |           |
| Arts nr.                    |  | Henvisning                                       |          | Bereg.           | Bereg.                                                                      |           |                                                                               |           |
| Gruppe nr.                  |  | 5700/89-90                                       |          |                  |                                                                             |           |                                                                               |           |
| Skuff nr.                   |  |                                                  |          |                  |                                                                             |           |                                                                               |           |
| Format                      |  | A 1                                              |          |                  |                                                                             |           |                                                                               |           |

Norsk Hydro a.s

Porsgrunn Fabrikker

Erstattet for:

Erstattet av:

5 F. 69916

Format A 1