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AVGANG OG AVGANGSDEPONERING

DIALOGSEMINAR OM BRUK AV SJØ, BERGEN 8.09.2011

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Ph.D. Environmental Engineering

- Evaluering og gjenvinning av mineralavgang, samt bruk av mineralforedlingsmetoder

- NFR prosjekt på Bjønndalsdammen, Løkken, (sammen med NIVA)
- EU prosjekt SAFEMANMIN (Safe Management of Mining Waste and Waste Facilities)
- EU prosjekt OMENTIN (Ore Mining & Environmental Technology Information Network)
- Mulig nytt EU prosjekt vht. bruk av mineral avgang…

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PLAN FOR PRESENTASJONEN

1. Hva er finkornet mineral avgang (*tailings*)?
   - Hvordan oppstår avgang
   - Hvordan varierer avgangens egenskaper
   - Hvorfor vi kan ikke bare bruke / selge / gi bort hele disse massene.

2. Ulike deponeringsalternativer
   - Fysiske, geokjemiske og tekniske aspekter.
   - Best available technique (BAT)
   - Hva sier regelverket?

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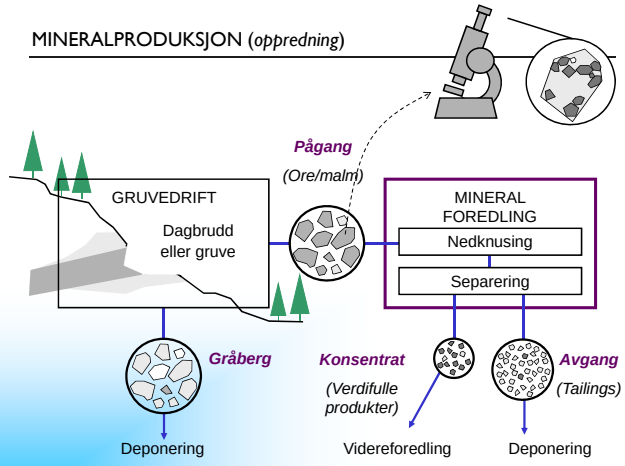
MINERALPRODUKSJON (*oppredning*)



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MINERALAVGANG (*Tailings*)

Mengde og type avgang er avhengig av mineralforekomsten. En kalkforekomst inneholder kanskje 95-97% verdifult produkt og 3-5% avgang, mens for en kobbermalm er det omvendt.

Avgangens partikkelstørrelse og kjemiske/fysiske egenskaper varierer enormt og er et resultat av forekomst og prosess.

Det er hovedsaklig naturen som bestemmer avgangens sammensetning.

Avgangen kan inneholde:

- Finknuste mineralpartikler.
- Vann.
- Prosesskjemikalier.
- Salter (pga. utfelling etter deponering)

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Uses of tailings –ideal, yes, but not so simple to achieve.
-It's all about the required product specifications…

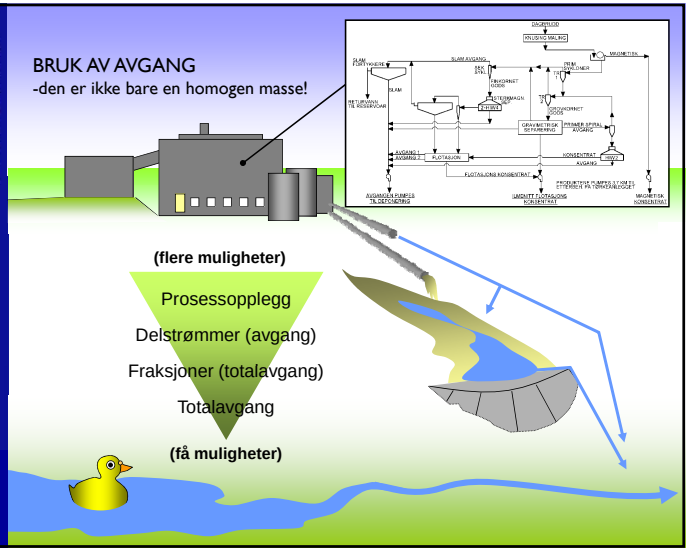
For industrial minerals many different factors are important, these must be satisfied before any part of a waste mass can be used:

- Chemical / Mineralogical Composition
- Optical properties
- Surface Charge / Surface Area
- Particle Grain Size/ Grain Distribution / Grain Shape
- Density / Hardness
- Absorption Capacity
- Neutralisation Capacity

All properties are interlinked and there must be **no unwanted components**!

All the technical factors must be satisfied before even taking into account the market situation, economy, logistics, transport distances etc...

BRUK AV AVGANG
-den er ikke bare en homogen masse!



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Why we can't generalise about uses of tailings:

- **Extreme variation in physical and chemical properties**
- **Natural weathering processes can alter minerals:** Once tailings are deposited, in particular, tailings with access to the atmosphere, oxidation of minerals such as sulphides over time will eventually transform them. This will change the chemical and physical properties of the tailings.
- **Recycling tailings can't be directly compared with standard metal recycling:** Metal containing tailings require sophisticated reprocessing procedures. Solid metal waste such as Al cans, mainly requires simple re-melting because they are already in a concentrated metal form.
- **Even if all this is achieved, there will always be a surplus of certain fractions whose deposition we will have to deal with, as long as we are a society that wants to use metals.**

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DEPONERING AV AVGANG

Årlig produseres enorme mengder gruve- og oppredningsavfall. Deponering av denne avgangen medfører ofte større problemer enn selve utvinnings- og foredlingsprosessene.

Miljøkonsekvensene av avgangsdeponering er avhengig av:

- Avgangsmengde
- Avgangens sammensetning
- Deponeringsløsning
- Resipientforhold

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ULIKE DEPONERINGSALTERNATIVER
Fysiske, geokjemiske og tekniske aspekter

Deponering i saltvann

Lav kostnad

Rask sedimentering pga. utsalting/flokkulering

Stabil høy pH, beskyttet mot oksidasjon og sur avrenning

Oppfylling av fjorder og endrede bunnforhold.

Deponering i innsjøer

Lav kostnad

Relativ stabil pH, beskyttet mot oksidasjon og sur avrenning

Oppfylling av innsjø og endrede bunnforhold.

Dep. på land (avgangsdammer)

Relativt kostbart, både anlegg og vedlikehold.

pH avhenger av ytre forhold, tett dam nødvendig for beskyttelse mot oksidasjon.

Arealkrevende – arealkonflikter

Støvflukt og estetiske forhold

Deponering under jord

Sjelden mulig å få plass til all avgangsmassen.

Både brytningsmetode og gruve må egne seg for tilbakefylling (geokjemi og stabilitet).

Legger ikke beslag på nytt areal

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CONCLUSIONS

1. There will always be a need to deposit tailings because of the huge volumes of material involved

-We must deal with this fact to get **realistic solutions**.

-Some reduction in waste volumes may be possible, but for the vast majority of minerals, large scale re-use is currently and for the foreseeable future, impossible.

2. We must use the Best Available Techniques (BAT)

- Norwegian, and EU law, as well as other international agreements oblige us to do this.
- BAT is a fundamental basis in international environmental engineering and environmental protection legislation .

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CONCLUSIONS

3.Tailings deposition to sea is not *per se* banned either in the U.S.A or Canada

- like Norway, the U.S.A. and Canada have a permitting system requiring initial Environmental Impact Assessment (EIA) and BAT before a permit can be given by the environmental protection agencies. Followed by evaluation during and after deposition.

4. Deposition to sea, as with all other alternatives, requires more research together with parallel research into use of tailings.

5. WE CANNOT GENERALISE ABOUT TAILINGS.

Tailings are complex materials, that require correct assessment. Each case must be treated individually because it is unique - we must:

DO THE JOB PROPERLY – EVERY TIME!

Because it's what the environment deserves.