

1. INTRODUCTION



**THE EFFECT OF ALKALIES ON THE PROPERTIES  
OF CONCRETE**

**THE OPENING ADDRESS TO DELEGATES ATTENDING  
THE 1976 SYMPOSIUM**

given by

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Dr. Sharp, Ladies and Gentlemen,  
My dear Friends,

It is a great pleasure to introduce and to chair the first session of the  
*Third International Meeting on the Effects of Alkalies on  
the Properties of Concrete at C&CA, Fulmer Grange.*

Each of the two preceding meetings, Køge 1974 (1), and Reykjavik 1975 (2), have been special in their character and arrangements. This one will be second to none in its own right and ways.

The preparatory work is so promising of success that failure is only to be expected if those attending are passive or do not present qualified contributions. And this is not to be feared.

Once upon a time a famous Danish storyteller wrote a fairy-tale called  
*The Ugly Duckling.*

It lived under great stress in a hostile environment, superficially condemned by the community for possessing inferior beauty and virtues. By a lucky opportunity the Duckling's underlying qualifications were revealed and became acknowledged.

I do not think that the broadening of the scope of this third meeting relative to the two preceding ones will *in itself* cause the reputation of alkalies in concrete to change from an »Ugly-Duckling« ignorance and fear-conditioned condemnation like bad and evil constituents of cement, to a »Young Swan« recognition of their true nature and usefulness in cement and concrete technology. Solidly established misconcepts and opinions do not change that easily.

When a few of us initiated this series of meetings some years ago, we felt that more exchange of newer knowledge between those actively engaged in research regarding the nature of alkalies in cement and concrete, would be beneficial.

We also thought that an arrangement of a broader meeting like the typical formal symposia, supported by international organisations and with representative presentations involved, would probably not become successful. We feared — or let me put this judgement upon myself — I feared that such an arrangement might even inflict damage and reinforced misconcepts on the further progress of the research, we deal with and care for, because we did not have any sufficiently new knowledge on alkali-silica reaction available and were not apt for presentation so as to meet the demand from our users of new knowledge:

The industries concerned  
Engineering practice  
Authorities

We did assume that the need for new knowledge was likely to increase soon due to the general economic development and rationalisation efforts in our industries, and also in view of the increasing pressure on the availability of the resources, especially in the most industrialized countries.

We did see it as a risk that this demand might soon cause practice to adjust cement and concrete technology from fear of alkali-silica reaction without considering newer knowledge or asking for help from new research — and that would be neither economical nor progressive in the further development.

Since then, the perspectives for the energy and the materials' resource demand, and also the economy of cement and concrete manufacture and utilization, have confirmed our views regarding the need for more knowledge, and fortunately our meetings are at the same time revealing that a considerable growth and improved status of the research concerned have occurred.

We know much better than 3 years ago in which areas more understanding of the nature of alkali-silica reactions is still required, and how to go for it.

However, concurrently, we must realize that views and opinions regarding the effects of alkalies in general tend to become more conflicting than before.

This is due to both the steadily increasing concern about the availability and the costs of suitable aggregates in many countries and to urbanization and industrialisation in areas with practically unexploited and unknown aggregate resources and with low levels of technical education, and also to the urgency for reducing expenses and energy consumption in cement manufacture. Influential are also the increasing public requirements for precautions against pollution of air, soils, and water, and the engineering drive towards improved utility of materials and design in construction practice and in housing, without exceeding reasonable safety regulations.

This is why research becomes increasingly exposed to conflicting demands for specific assistance and service regarding alkalies in cement and concrete.

Unfortunately, the need for general, underlying scientific research in its own right — to create more knowledge — carries less weight than in the past, both in the society and in industries, yes, even in the formalized international research cooperation.

And this again is why enthusiastic dedication is required on the part of the researchers to make the »Ugly-Duckling« misconception of alkalies in cement and concrete change into realistic approaches and fruitful communication about the true nature and extent of the problems.

That can only be achieved by establishing the relevant knowledge on alkalies all along their pathway: as constituents of the cement materials, as influential during the cement manufacturing processes and the concrete making, and in the end as »bacteria« causing chemical reactions in hardened concrete under certain conditions, and thus adversely affecting the durability of structures, houses, etc.

Such a comprehensive and coherent disclosure of the nature and effects of alkalies is what the programme committee for this meeting has invited the participants to commence.

The papers announced for presentation show that the importance of this approach is appreciated.

Nevertheless, we must acknowledge that there are colleagues in production and sales departments of cement and concrete industries who think that the most advantageous situation

exists, if no one becomes aware of «alkali-problems», so that national and international concern would remain entirely avoided. Such attitudes can only be explained by saying that research has not yet done its job properly. — The communication to colleagues and business operators has not yet become effective. In other words, the value of *knowledge* has not been sold to the users of research.

Let us therefore consider what makes the cement consumers concerned about alkalies, since they constitute the most numerous among the customers of our research, and they manage by far most of the invested capital in the cement and concrete business sector.

A few figures may illuminate the present situation. The annual cement sales are:

In Denmark . . . . .	0.1	Bill. dol.	
- USA . . . . .	4.0	-	-
- the World . . . . .	35.0	-	-

whereas the annual «sales» of concrete can be estimated as follows:

In Denmark . . . . .	0.5 — 0.8	Bill. dol.	
- USA . . . . .	25 — 30	-	-
- the World . . . . .	200 — 300	-	-

The research on alkalies in cement and concrete has a true global interest and applicability. Accordingly, there is a demand for this research represented by an annual sales-value of 200 — 300 Bill. dol. from cement consumption enterprises, against 35 Bill. dol. from cement manufacturing business.

Which is then the cement consumers' request on service from our research:

First, the cement consumers have a certain knowledge about the influence of the alkalies on the strength development of concrete. Therefore, research is requested to offer more guidelines for an improved utilization of this dependance. However, beyond the strength specifications based upon which the consumer buys his cement, and pays for its properties, there is real profit to gain from strength/alkali dependance only for a minority of cement consumers, namely those operating accurately monitored industrial cement product manufacture. In normal engineering practice so many factors other than the alkali contents — and much easier to adjust — are decisive for the strength development, so that the alkali contents is a useless measure as a controlling parameter in practice, and this is even more the case in handcraft dominated concrete making.

This is also the reason why the cement consumers so easily preserve the picture of alkalies in cement and concrete as predominantly associated with deterioration, or as it has been said: Alkali-silica reaction is a type of concrete cancer, in which the alkalies from the cement and the silica from reactive aggregates act as the virus.

This 200 to 300 Bill. dol./year concern on the part of the cement consumers cannot be disregarded by research. Neither can we serve the consumers by enabling removal of alkalies from cement or by restricting aggregate acceptance to innocuous materials only, to secure durable rentability of these investments. This is not feasible, and therefore research must also consider the cement and aggregate producers' problems.

There are for instance often good reasons for maintaining high alkali contents in cement deriving from the nature of the raw materials, the economy of kiln operations and investments, the »clean air, water and ground« policies and the increasing restrictions on the aggregate resource utilization.

None of us here can believe that there are other ways out of these dilemmæ than what can be established through new knowledge which is sufficient to secure:

1. Reasonable engineering compromises at the present stages of cement and concrete technology, and
2. Future development of technologies which aims at reducing costs to be imposed on concrete by restrictive precautions or failures caused by neglectance of precautions.

Let us at last look at the problems as viewed from the side of the authorities, upon whom the society inflicts more or less unspecified general responsibility for:

1. Reduction of energy and materials resource consumption, and planning of the overall national or regional development,
2. Reduction of pollution and, alternatively, utilization of waste products, and
3. Economy of public engineering works — more than often as incompatible demands on minimum initial expenses and maximum service lifetime at lowest possible maintenance expense levels.

It is easy to see that these different positions of immediate responsibilities may well create all kinds of *apparently* conflicting views and interests, if everybody concerned is evaluating and deciding on a case-to-case basis, and also very different evaluations as far as planning for long-term investments and development is concerned.

One must also be aware *that* the authorities as the overall political controllers do not themselves invest in the manufacturing crafts and industries, *that* the cement manufacturers are predominantly locked for long periods to given manufacturing technologies, and *that* the cement consumers who possess most of the technology flexibility generally speaking have the least capability available for exploitation of their development potentials.

Because of this very complex and fragmented technology/economy/responsibility background, the research (which annually comprises only microscopic efforts in relation both to cement production and cement consumption investments) has not yet been able to remove the »Ugly-Duckling« policies which one or the other partner in the cement and concrete enterprises still often chooses as a defensive position.

This is why the core of dedicated exchange of background and applicable knowledge and ideas to be presented at this meeting is so important as a nucleus for the creation of a broader progressive environment — to the benefit and economic advantage for all parties involved.

During our series of meetings the growth of a collegial sense of forming part of a multitude for the promotion of valid knowledge creation is one remarkable achievement.

But more pragmatically seen: the results and the markedly increasing intensity of new matters presented in the contributions prove the benefit/cost ratio of these gatherings to be very satisfactory.

Thus, also from a cooperative and a research rentability viewpoint I have great confidence in the output of this third meeting.

As a conclusion I should like to thank a high officer of an organisation of true authority — the ASTM —, namely Mr. Bryant Mather, and an American, public sponsor of international research cooperation — the European Research Office of the US Army Corps of Engineers — represented by Mr. Hoyt Lemons, for having so strongly supported our arrangements, each in his way.

I feel convinced that their confidence will be duly repaid in that with the added value of the two preceding meetings we can begin to see a way to compile and present much needed information from our research workshops to our customers: industries, consumers, the public.

I should very much like a forthcoming meeting to deal also with these aspects of our topics.

With thanks to C&CA and Queen Mary College for the arrangement of facilities and programme etc. I am pleased to open the first session of our conference.

G. M. Idom

**Literature:**

- (1) Aalborg Portland R&D Seminar on Alkali-Silica Reaction, Hotel Hvide Hus Køge, Denmark, 20-21 May, 1974, presented by AP-R&D
- (2) Symposium on Alkali-Aggregate Reaction Preventive Measures Reykjavik, August 1975, Iceland Rannsóknastofnun Byggingaríðnadarins