Report of the workshop on the application of dispersants in the North Sea

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Contents

Background

The workshop on the application of dispersants on oil spills in the Dutch part of the North Sea was held on Tuesday 2nd of October 2007 and was organized by Rijkswaterstaat, Ministry of Transport, Public Works and Water Management, the Netherlands. Strategy planners from different ministries of the Netherlands, oil spill response experts from Europe, European Maritime Safety Agency (EMSA), members of the Bonn Agreement, scientists, oil spill response advisors and response personnel, coastguard, environmental organizations and North Sea-user organisations in the Netherlands have been invited to participate (Appendix A).

In 2006 Rijkswaterstaat published the new Capacity plan titled "For the protection of vulnerable sea- and estuarine areas". The plan provides the answers to questions addressed to Rijkswaterstaat on the response measures to (the threat of) environmental damages at sea and in estuaries. In the plan the application of dispersants as a response method to oil slicks is mentioned as a viable option.

In the Netherlands, the use of detergents in oil spill response had been banned since the 1970s. The main reasons for this change in policy are that in recent years new dispersant products have become available which are less environmentally harmful (high biodegradability, low toxicity) and more effective (less product necessary and applicable to a broader range of oil types and circumstances). In addition, there is a desire to harmonize international policy for oil spill response in the North Sea region, where most countries apply dispersants as a secondary option. In the Netherlands the plan is to use detergents only in those cases where mechanical response is not enough for preventing the oil slick from moving into an ecologically or economically sensitive area.

In order to effectively permit the application of dispersants, defining conditions and a decision tree are required. This workshop was organized to discus what is needed in a decision tree that can be used in a practical application framework.

Presentations

The presentations held at the workshop can be downloaded at the website of Wageningen IMARES (http://www.wageningenimares.wur.nl/UK/Dispersants-RWS/links/).

The following topics were presented:
- Different aspects of oil spill dispersants
  by Dr. Alun Lewis, Oil spill consultant
- Current practice in response methods in The Bonn Agreement
  by Sjon Huisman, Rijkswaterstaat Noordzee
- Strategic & operational aspects of the application by aircraft
  by Chris Frances, Maritime Coastguard Agency UK
- Ecological sensitivity in the Netherlands part of the North Sea
  by Jan van Dalfsen, IMARES

Available tools presented at the workshop

SIMAP with dispersed oil module
By Deborah French McCay (ASA)

The tool "SIMAP" is developed by ASA and predicts the trajectory, fate and biological effects of spilled oil (and dispersants). The model evaluates the potential impact for birds and water column organisms. It assesses the size of the affected area or water volume for birds and water column organisms. Impacts of dispersed oil versus other response options can be determined so the relative impacts of options can be used to guide response decisions during future spills. Field data of experiments with dye (transport and dispersion) were used to validate model results.
For more information visit the ASA website http://www.appsci.com/simap/index.htm, or contact Deborah French McCay (dfrench@appsci.com).

Support tool for dispersant use
By Walter Nordhausen (EMSA)

The EMSA "Decision Support Software Tool on the Applicability of Oil Spill Dispersants" contains a software program that allows the user to compare information about a specific oil, its "weathering" characteristics and its dispersability. It assists in the selection of the most appropriate dispersant relative to the type of oil spilled at sea and supplies information regarding dispersant effectiveness, application and availability.
For more information visit the EMSA website http://www.emsa.europa.eu/.

Results from the discussions

For the workshop discussion, four groups were formed. Each group started with a set of questions covering one topic of dispersant application in the Netherlands: approval of products; comparing impact of dispersed oil with undispersed oil; operational restrictions; and monitoring (Appendix B). The group members selected the most important questions within their topic. These questions were then discussed. Furthermore, each workshop participant was requested to write down a recommendation (Appendix C). Finally, each group reported the main outcome of their discussion, which was then discussed plenary.

A)   Approval of products

M. Ferdinandy (chairman), J. Tamis (reporter)
Key question of this discussion was: which criteria are important for the approval of specific dispersant products?

- France and the UK are the only countries within the Bonn Agreement that have an approval procedure of oil spill dispersants. Norway has adopted the French system. It was recommended that the protocols should be studied first.
- REACH[1] introduces in 2008 the "safe use" for product substances above 10 tons. The manufacturer is obligated to prove the safety of its product/substance by means of exposure and risk assessment. This is expected to apply for dispersants. According to the REACH framework, only the product requires assessment and approval. However, to prove "safe use" a risk assessment of the product-oil mixture could be required.
- For test procedures, we should distinguish between realistic and worst-case exposure. Worst-case exposure should be used to assess the potential risk and not the actual risk, which is different in every case. For approval the potential risk should be assessed.
- It is recommended to only approve type III dispersants and not products of the 'old stockpiles' still present and used in the UK.
- Data of chemical substances (components of dispersant products) are available through EINECS IS (European INventory of Existing Commercial chemical Substances Information System).

Recommended approach on approval
- As a precondition, the product must be effective.
- Approval of product:
  - o   Dispersant only (REACH);
  - o   Study the test protocols of UK, France (and Norway), currently 5 products are approved by both countries. The intention is to approve these products in the Netherlands;
  - o   Tests with at least 3 species of 3 trophic levels (algae, crustacean, fish), in agreement with the European approach (REACH, TGD), is recommended.
- Approval of use:
  - o   Risk assessment (REACH);
  - o   Toxicity tests of oil and dispersant mixture. Caution should be taken when using this criteria for approval of products, because it discriminates against effective dispersants. In principle: the more effective, the more toxic.

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[1] EU regulatory framework for Registration, Evaluation, Authorisation and Restriction of CHemicals (REACH), adopted on 18 December 2006

B) Comparing impact of dispersed oil with undispersed oil

J. Huisman (chairman), N. Jonkers (reporter)
Key question of this discussion was: how can different types of ecological impact of dispersed/undispersed oil be compared?

- Comparison of different types of ecological impact is not possible by using a decision tree.
- Economic impact should be included but is always second priority.
- A contingency plan should include as much expert opinion as possible. It should form a 'rough' decision tree. During an actual spill the plan/decision tree and sensitivity maps should be 'fine tuned' by experts.
- Distinguish between preparation phase and response phase. The conventional risk assessment procedure distinguishes between potential risk assessment and actual risk assessment.
- Suggestion is to use a safe level of application by using a maximum volume of oil that should be dispersed and therewith the concentration of dispersed oil in the water column always stays below the maximum acceptable concentration. In such a case focus could only be on birds. However, such a weighing is regarded as over-simplified.
- In case of an oil spill in Belgium a scientific team decides on the response option. Experience from Belgium learns that within the first days, expert contribution is very valuable.

Recommended approach on comparing impacts
- Preparation phase:
  - o Scientific input on forehand;
  - o Develop decision tool.
- Response phase:
  - o In the first hours, use the decision tool;
  - o As a second step, use expert judgment to fine tune.

C) Operational restrictions

R. de Boer (chairman), A. Visser (reporter)
Key question of this discussion was: how can we deal with the operational restrictions in using dispersants?

- There are three different types of restrictions distinguished:
  - o Technical restrictions (for example, is it effective on the type of oil?)
  - o Environmental restrictions
  - o Operational restrictions
- For saving time in the decision process, the suggestion is to always start with mobilizing the spray aircraft(s) if chemical dispersion is a possible option. In that case you have at least another 6 hours to discuss further and stop the application if the use cannot be justified. However, this is a very expensive option (and probably not cost-effective).
- The MCA contract is until 2010. If MCA response time would be at least 10 or 12 hours, for future plans, other options should be considered.
- It is noted (A. Lewis) that there is a very short time available for the Dutch situation. It takes a couple of hours before the oil reaches the shore in case of an oil spill in the shipping channel; 6 hours flight time might be too long anyway.

D)   Monitoring

D. Knoester (chairman), W. Koops (reporter)
Key question of this discussion was: how should short and long term effects of dispersed oil be monitored?

- Most important is monitoring of effectiveness
- Monitoring of effectiveness should be incorporated into the decision tree
- There are two approaches for effectiveness monitoring
  - Visual by checking whether there is a plume. Visual observations are possible with a clear sky. A brown plume indicates dispersed oil (effective) and a white plume indicates the presence of the dispersant (not effective. A French study suggests that visual observation is limited: observers reported an oil spill effectively treated when in fact no dispersant had been applied. It is therefore recommended (by ITOPF) that focus should be on looking if there is no effect (no change in appearance) instead of looking for effect (plume). It is not possible to assess the effectiveness by visual observation, it is only to indicate if it is not effective. Another option is UV, which is cheap and simple. The problem with this technique is that it is used on vessels.
  - Assessment of the dimension of the slick by remote sensing. With effective use the dimension should decrease
- Monitoring of concentration and ecological effect is also important. It is noted that this is important for all oil spills, not only when dispersants have been used.
- Monitoring data will improve future decision making.
- Should make use of computer models (spreading) to indicate were to take samples
- Could make use of biological monitoring such as the Musselmonitor
- In the monitoring program distinction should be made between different phases:
  - Action phase (plume is spreading)
  - Short term phase (first days)
  - Long term phase
- Baseline data should be available
- A suggestion was made to assess the possibility to prevent birds from entering an oil polluted area. Research should be performed on that option in case this has not been conducted yet.

Suggestions for further actions

As a follow up of this workshop it was suggested to setup a few scenario's and discuss these: what could happen and what could we do to prevent that from happening?
EMSA is willing to support such a workshop.

Evaluation and closing words

by chairman, Chris C. Karman, Wageningen IMARES

Comparing ecological impacts
The debate fish versus birds is difficult and perhaps impossible to make up the balance. There were two important issues resulting from this workshop and these should be discussed further:
- The role of sensitivity mapping;
- The role of experts.

Operational restrictions
The most important operational issue was the mobilization time, i.e. the time needed to arrive on scene and apply the dispersant after the decision is made (fly time). From Coventry to the DCS takes at least 6 hours and maybe 10 to 12 hours. Other options (equipment in the Netherlands or other countries) should be considered.

Monitoring
Monitoring is important in all major oil spill situations. A basic monitoring plan should be prepared so that it can be applied when necessary. It is recommended to use computer models to determine the sample locations.

Approval procedures
It was not recommended to simply adopt the French and UK approval scheme and underlying tests. We should study the existing test procedures and conditions and develop our own criteria.

Appendix A. List of workshop participants

Name	Organisation	Country	Discussion group
Alun Lewis	AL	UK	
Debora French McCay	ASA	USA	
Wierd Koops	ASCC	The Netherlands	D
Walter Nordhausen	EMSA	Germany	A
Chris Karman	IMARES	The Netherlands	
Jacqueline Tamis	IMARES	The Netherlands	A
Jan van Dalfsen	IMARES	The Netherlands	D
Helen Chapman	ITOPF	UK	D
Hugh Parker	ITOPF	UK	C
Bert van Hattum	IvM	The Netherlands	A
Bert Veerman	KIMO	The Netherlands	
Anja Nachtegaal	Kustwacht	The Netherlands	C
Chris Francis	MCA	UK	
Ronny Schallier	MUMM	Belgium	B
Jacob Bart Hak	RWS	The Netherlands	D
Aart Tacoma	RWS	The Netherlands	A
Arie Visser	RWS	The Netherlands	C
Bert van Munster	RWS	The Netherlands	C
Dennis Kalf	RWS	The Netherlands	A
Dick Knoester	RWS	The Netherlands	D
Dick Vethaak	RWS	The Netherlands	D
Jan Kool	RWS	The Netherlands	A
Janny Pijnenburg	RWS	The Netherlands	A
Marijke Ferdinandy	RWS	The Netherlands	A
Niels Jonkers	RWS	The Netherlands	B
Rolf de Boer	RWS	The Netherlands	C
René Algra	RWS	The Netherlands	
Serge Rotteveel	RWS	The Netherlands	D
Sjon Huisman	RWS	The Netherlands	B
Theo Kramer	RWS	The Netherlands	
Paul Kienhuis	RWS	The Netherlands	
Luitze Bijlsma	RWS	The Netherlands	
Pieter Jan Komduur	RWS	The Netherlands	
Peter de Wit	RWS	The Netherlands	
Laura della Torre	SASEMAR	Spain	B
M. Mentink	Smit Salvage	The Netherlands	
Jeroen Dagevos	Stichting de Noordzee	The Netherlands	B
Eelco Leemans	Stichting de Noordzee	The Netherlands	
Pim de Voogt	UvA	The Netherlands	A
Geert Drost	V&W-DCC	The Netherlands	
Jan-Willem Bil	V&W-IVW	The Netherlands	A
Emina Salikovic	V&W-IVW	The Netherlands	B

Appendix B. Discussion topics and questions

Discussion group A.
Which criteria are important for the approval of specific dispersant products?

- Which is the current general procedure for approving chemical products in The Netherlands?
- Should the approval procedure of oil spill dispersants be different in any way?
- France and the UK both have lists with approved dispersants. Both countries tested these dispersants on effectiveness and toxicity. Still, there is an overlap of only 5 products (not all products were tested by both countries). Should we also approve those 5 products? Or all products on both lists?
- Modern dispersants (Type III) have as active ingredient often the relatively well-biodegradable fatty acid esters, ethoxylated fatty acid esters or sodium di-iso-octyl sulphosuccinate. Dispersant percentage is 25-60%, with oxygenates (e.g. glycol ethers) as solvent.
- Some of the products in the UK list of approved dispersants are of type I/II (see literature below). Should these type I/II products be considered for use in The Netherlands?
- Should the candidate dispersants be tested (again) by The Netherlands?
- Which kind of criteria should weigh heavier: effectiveness in dispersing oil, or ecological impact (toxicity, biodegradability)?
- Which type of toxicity testing is more relevant: toxicity of the dispersant alone, toxicity of a dispersant-oil mixture, or a comparison of undispersed and dispersed oil?
- How should this topic be incorporated into the "decision tree on whether or not to use detergents in a specific oil spill situation"?

Specific sections on this topic in the on-line literature
(see http://www.wageningenimares.wur.nl/UK/Dispersants-RWS/links/):
- EMSA'06, p.10-17 (comparison old and new dispersant types, general composition, recent innovations)
- EMSA'06, p.66-71 (dispersant testing policies EU countries)
- EMSA'06, p.72-73 (regional agreements on dispersant use)
- Bonn Agreement '05, par.20.1 (approaches of North Sea countries to dispersant approval)
- Bonn Agreement '05, p.8-9 (list of dispersants approved by France and UK)
- CEDRE'05: p.12-13 (types of dispersants)

Discussion group B.
How can different types of ecological impact of dispersed/undispersed oil be compared?

- Toxic mode of action will be different for dispersed and undispersed oil: for undispersed oil, the mechanical effects are dominant (e.g. on birds), while for dispersed oil toxic effects after ingestion of oil components will be important. How can these be compared?
- Different organisms respond differently to oil pollution: birds may be attracted to the seemingly calm "water surface" of an (undispersed) oil spill, while fish may detect the higher (dispersed) oil concentrations in the water at an early stage, and swim away from it. Could this be incorporated into the comparison?
- Which laboratory tests would be needed to assess the ecological impacts? Which problems arise when extrapolating these results to the field?
- Which type of toxicity testing is more relevant: toxicity of the dispersant alone, toxicity of a dispersant-oil mixture, or a comparison of undispersed and dispersed oil?
- Which other aspects play a role in deciding which ecological impact is more problematic (e.g. water depth, sensitive areas, season)?
- Should dispersants be used when economically important areas (e.g. tourist beaches) are threatened? should any additional ecological/economical or other impacts of oil pollution be considered?
- Are maps with ecologically sensitive areas in the North Sea available and ready-to-use?
- How could a NEBA (Net Environmental Benefit Analysis) be performed, considering the different possible environmental impacts?
- How should this topic be incorporated into the "decision tree on whether or not to use detergents in a specific oil spill situation"?

Specific sections on this topic in the on-line literature
(see http://www.wageningenimares.wur.nl/UK/Dispersants-RWS/links/):
- EMSA 2006, p.17-23 (recent dispersant innovations, NEBA, toxicity)
- EMSA 2006, p.36-37 & 74-75 (laboratory tests for effectiveness)
- EMSA 2006, p.76-77 (laboratory tests for toxicity)
- Capaciteitsnota 2006, p.21-27 (ecologically sensitive areas)
- CEDRE 2005, p.22-23 (NEBA)
- TNO 2004, p.20-22 (consideration of ecological effects, in Dutch)
- SINTEF 2001, p.18-23 ("fish versus bird" debate)

Discussion group C.
How to deal with operational restrictions in using dispersants.

- Which is the current procedure for applying mechanical recovery of oil spills (which will remain the primary response option for The Netherlands)? Which information is provided to the oil recovery ships, and by whom?
- Which information should be prepared in advance and be readily available to the alarm group/ decision makers (e.g. types of oil transported on the North Sea, dispersants in storage)?
- Which information is required to decide if dispersants are going to work (e.g. oil type, viscosity, weathering)?
- Which information is required to decide if it is practically possible to spray the dispersants (e.g. weather conditions)?
- Which information should be provided to the aircraft crew before they take off (e.g. size and direction of movement of oil spill)?
- How does the pilot make the final ('last-second') decision whether or not to spray the whole spill area (after testing on a small part of the spill)?
- At high wind speeds, ships cannot perform mechanical treatment due to high waves, but aircraft may not be able to spray either, as the wind will blow away all detergent before it reaches the oil. Which would be the "window of opportunity" for dispersant use with respect to weather conditions?
- In which timeframe should the decision be made whether or not to send out the aircraft with dispersant?
- Are the operational restrictions for the Dutch part of the North Sea different than for other countries (e.g. large part with low water depths)?
- Are maps with ecologically sensitive areas in the North Sea available and ready-to-use?
- Are hydrogical prediction models for the movement of oil spills in the North Sea sufficient and ready-to-use?
- Are oil weathering/ natural dispersion prediction models sufficient and ready-to-use?
- How should this topic be incorporated into the "decision tree on whether or not to use detergents in a specific oil spill situation"?

Specific sections on this topic in the on-line literature
(see http://www.wageningenimares.wur.nl/UK/Dispersants-RWS/links/):
- EMSA 2006, p.24-33, 50-51 (situations in which dispersants can or cannot be used),
- EMSA 2006, p.52-61 (operational considerations in dispersant spraying)
- Marine Pollution Bulletin 2007, par. 3, 4 & 8 (past experiences with the decision process and response planning)
- Capaciteitsnota 2006, p. 39-45 (Dutch strategy and approach for countering chemical spills in the North Sea, in Dutch)
- CEDRE 2005, p.10-11 (when can you spray dispersants?)
- CEDRE 2005, p.28-46 (operational considerations in dispersant spraying)
- TNO 2004, 23-29 (considerations when to use dispersants, in Dutch)

Discussion group D.
Monitoring short and long term effects of dispersed oil.

- Distinguish between 3 types of monitoring:
    - monitoring the effectiveness of the dispersant in dispersing the oil,
    - monitoring the aqueous concentration of oil and dispersant,
    - monitoring ecotoxicological and ecological impact.
- Are all 3 types of monitoring necessary after the use of oil spill dispersants?
- What could be learned from monitoring studies?
- How could the monitoring be performed?
    - effectiveness: visual inspection, UV-measurements?
    - aqueous concentrations: how can water samples be taken (e.g. throwing water samplers from the aircraft, using buoys as reference point to fix sampling locations relative to the oil spill)? for how long? should both oil and dispersant be determined? how much time in the lab would be needed?
    - ecotoxicological effects: Which organisms should be considered? Which endpoints should be measured? What should be considered as the reference uncontaminated situation? Should possible decreases in fish catches/bird colonies be investigated?
- How should this topic be incorporated into the "decision tree on whether or not to use detergents in a specific oil spill situation"?

Specific sections on this topic in the on-line literature
(see http://www.wageningenimares.wur.nl/UK/Dispersants-RWS/links/):
- Marine Pollution Bulletin 2007, par.5 (monitoring effectiveness)
- Marine Pollution Bulletin 2007, par.6 (ecological monitoring, e.g. fish catches after Sea Empress oil spill)
- CEDRE 2005, p.49, p.52
- EMSA 2006, p.38-41 (measuring effectiveness),
- EMSA 2006, p.62-64 (measuring effectiveness using visual/UV methods)
- CEDRE 2005, p.49-52 (monitoring effectiveness)

Appendix C. Recommendations

List of recommendations of the workshop participants, presented per discussion group

Discussion group A.
Which criteria are important for the approval of specific dispersant products?

- Include REACH-based information in risk assessment of dispersants
- Use model-based predictions of environmental concentrations
- Information from French, UK and Norwegian admission procedures seem to be too limited

Bert van Hattum

- Comply with REACH legislation in the approval of dispersants
- Make a risk assessment of the dispersants approved by France, UK and Norway
- Use model calculations (as demonstrated) to estimate hazards of oil-dispersant mixtures in sea
- Validate these estimations by lab or mesocosm studies using marine water and marine organisms

Pim de Voogt

- Reach an EU-wide agreement: harmonize accepted tests of France, UK and Norway and other requirements.

Jan

- Don't bother with the full acceptation of tests, but indicate limits of acceptance concerning toxicity. Take mixing with a lot of water into account.

Jan

- Do not simply adopt (parts of) lists or test protocols of UK, F, N. Harmonize test protocols with REACH (is obligatory anyway)
- Apply existing OECD protocols (in accordance with REACH) using marine data.
- Focus not only on acute toxicity, also bear in mind persistence, biodegradation, bioaccumulation

Aart Tacoma

- Approval of a dispersant is one, actual use in the Netherlands is two. Step 2 also involves considerations of long term effects and area threatened.

Janny Pijnenburg

- Make a table with all criteria/issues and determine where data is lacking. Try to fill in those gaps. What is left could turned into relevant research projects.
- All relevant legislation (REACH etc.) must be put together for e.g. the 5 products from the Bonn Agreement

Dennis Kalf

Discussion group B.
How can different types of ecological impact of dispersed/undispersed oil be compared?

- Are the Netherlands not too small to spray dispersants on their own?
- What has changed in recent years? Why would mechanical recovery methods not be sufficient anymore?
- It should be clear that there is a choice: mechanical recovery, do nothing, or in exceptional cases spray dispersants.

Emina Salikovic

- NEBA should start at the contingency planning stage, with an analysis of oil pollution scenarios and possible impact.
- Nevertheless, every incident is different, and a NEBA evaluation (expert judgment) is also part of an incident decision-making process.

Ronny Schallier

- Europe should be working towards a common approach about the use of dispersants, taking into account the criteria, the approval tests and the operational equipment needed.
- What about the dispersants which vessels are carrying for their own use?

Laura della Torre

- How to deal with oil spills?
- Mechanical recovery, do nothing, or use dispersants.

Jeroen Dagevos

Discussion group C.
How to deal with operational restrictions in using dispersants.

- First answer the question when we expect to (be able to) apply dispersants ("realistic need").
- Develop a map like France with colored areas: green (dispersion is no problem), yellow (dispersants can be used under certain conditions), red (never disperse)

Rolf de Boer

- Determine through risk assessment the most likely scenario when use of dispersants might be called upon and develop operational arrangements accordingly
- Develop dispersant use map showing: red – forbidden; amber – maybe, circumstance specific; green – limited, check of probable effectiveness

Hugh Parker

- When use dispersants? At which spill types? It should be clear in advance that dispersants are only used for large spills, or it will not be possible to use the UK aircraft

Anja Nachtegaal

- Operation start is not the problem.
- How do you organize cooperation with UK?
- Questions still:
  - colored decision maps (only France has it?)
  - ecological sensitivity (60% known?)
  - prediction models (??)

Bert van Munster

- Sensitivity maps !!

Arie Visser

Discussion group D.
Monitoring short and long term effects of dispersed oil.

- Divide monitoring in:
    action phase (for the decision tree)
    short tem phase
    long term phase
Dick Knoester

- Baseline data / prespill data should be available for any monitoring
Dick Vethaak

- If birds are most in danger, why no research on how getting the birds out of the (potentially) polluted area?
- If the aircraft from the UK takes 12 hours to mobilize, is it still useful in the Dutch situation?
Wierd Koops

- There area rarely any straightforward "yes" or "no" answers in oil spill response.
Helen Chapman

- The actual presence of sensitive species at the moment of an oil spill is of higher importance than general maps of sensitive areas, although these will help to assess the possibility of an existing risk.
Jan van Dalfsen

- Make a clear distinction between science and what you should know in case of a calamity.
Serge Rotteveel

- Monitoring effectiveness → on short notice, needs immediate action
- Monitoring effectiveness on long term needs long term commitment
- An open eye to monitoring studies is demanded
Jaap Hak

Authentication

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