



Overview of existing users and stakeholders of the Copernicus Atmosphere Monitoring Service (CAMS) in The Netherlands

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Contents

Introduction	5
1. Plans for future communication efforts	6
1.1 Focus topic	6
1.2 Workshop	6
1.3 Other communication efforts	7
1.4 Planning	8
2. Existing users of CAMS products in The Netherlands – task 7261	10
2.1 Stakeholder Overview	10
2.1.1 National Institute for Public Health and the Environment (RIVM)	10
2.1.2 Other users	10
2.2 Current CAMS projects and products in The Netherlands	11
3. Potential users – task 7262	13
3.1 Provinces and municipalities, with a regional responsibility, and environmental agencies	13
3.2 Health	13
3.3 Businesses and start-ups	14
3.4 Other	14
4. Existing communications channels	17
4.1 Dutch social media channels of the biggest institutions in Air Quality and satellite data	17
4.2 Other channels	18



Introduction

The Communication work package of the CAMS-NCP project (Copernicus Atmospheric Monitoring Service, National Collaboration Project) (*CAMS_72_NL-NCP*) aims to support and improve communication about the use of CAMS products in The Netherlands, on the national, regional and local level. The main objective of this work package is to increase awareness, understanding and uptake of the various available CAMS products in The Netherlands. A secondary objective of the work package is to collect feedback from users for a better alignment of CAMS products to user needs.

To meet these objectives, it is crucial to gain an overview of the national context within which CAMS operates: what is CAMS aiming for and how does this translate to The Netherlands, what are the most important channels to focus on, and who are the target audiences. This context provides important background information to further design our communication plan and to define what activities are envisaged. In this deliverable, the findings of our initial analysis are summarized. This deliverable provides a stepping stone towards the design of an effective communication plan. One envisaged important element is a ***user engagement workshop*** in 2024 that would be instrumental in the translation and embedding of CAMS products to the context in The Netherlands.

Chapter 1 contains an overview of the communication efforts we are planning. Here, we explain our focus topic, we elaborate on the user engagement workshop, on other communication efforts and our intended timeline.

Chapter 2 contains information on the existing users of CAMS products (Task 7261) in The Netherlands, as well as a starting point for an overview of the existing CAMS projects, including products and users, in The Netherlands.

In Chapter 3, we describe potential users of CAMS products in The Netherlands (Task 7262) including provinces, health organizations, businesses, and start-ups.

Finally, Chapter 4 gives a brief overview of the current communications channels already in place.



1. Plans for future communication efforts

We are working on creating an overview of the different CAMS products. This overview will include the products that we are producing, providing and/or using within our organisations TNO, KNMI, and RIVM. Also, the current and potential CAMS users of these products are being mapped. In this way we will be able to identify and target opportunities for effective and convincing communication efforts. Communication is most effective when different products relate to and support each other, as well as when clear goals and target audiences are defined, including the user needs. To support decision-making in this regard, we held interviews with a few key people within our organizations that are experts in the field. Based on these initial findings, we proposed preliminary ideas to the CAMS-NCP team and further discussed these ideas during an internal CAMS-NCP management meeting with the three organizations. Together, we came to a contour for our communications plan.

Within the communications work package of the CAMS-NCP program, our efforts can be split into two groups:

- 1) The creation of communications products
- 2) User engagement workshop: as agreed upon in the proposal

Communications products will be created for general outreach efforts of CAMS as a part of our own communications, and the target audience will be large. The user engagement workshop will have a small and defined target audience.

1.1 Focus topic

Our communication efforts aim to both support the goals of this project, and the overall communications strategy of our organisations. As will be discussed in Chapter 3, a wide range of CAMS products are used or supported by our organisations KNMI and TNO. For now, we have decided to focus our communications on the work related to 'Source Apportionment'. This was decided because:

- 1) The work on Source Apportionment is at a stage of development where we can show some initial results, yet still tailor it to input we may get from a user engagement workshop.
- 2) It fits well with TNO's current focus and ambitions.
- 3) We believe that our current developments in the Source Apportionment work give rise to interesting new opportunities, where we could reach and partner up with new potential users.

During discussions within the team, it was decided that the current stage of the downscaling work is not mature enough to communicate about this. However, as the development of downscaling is a key aspect of the work in CAMS-NCP, we would like to include it in our communication plans. If budget allows for it, we want to communicate about downscaling towards the end of the project. Otherwise, this will become the focus topic of next years' communication efforts.

1.2 Workshop

In line with the other communication efforts, the workshop will focus on Source Apportionment. The aim of this workshop is twofold:



- 1) Communicate and raise awareness about Source Apportionment and its potential uses.
- 2) Gain input from user groups to learn about their needs, with the aim to tailor our current developments to their needs.

We decided to focus the workshop on a small group of people, that we chose individually. This way we hope to reach a range of target audiences, while also making sure they have similar needs to enable useful discussions. We will invite both potential and current users, as well as people who are new to or experts in the field. We will show the possibilities of using source apportionment, and our planned near-future development. This way we will reach new organisations and increase the visibility and uses of CAMS and related products in the Netherlands. From the experts in the field, we will try to learn about their insights and get input for future developments.

Our current list of organisations to invite:

- RIVM – Smog team. They may be interested in the use of Source Apportionment. We want to invite new and more experienced colleagues. New, to introduce them to CAMS. More experienced, because they can provide valuable insights for future developments. Our RIVM partner Joost Wesseling will set up a list of invitees.
- RIVM – Emissions team. Potentially, we could invite people focusing on emissions, depending on the exact content of the workshop. Joost Wesseling will reach out to them and discuss possibilities.
- RIVM - Citizen Science group ‘Samen Meten’ (‘Measuring Together’). This group consists of citizens, often retired scientists that are very engaged in the Dutch science community. Our RIVM partner Joost Wesseling is involved in this group and knows 3-4 people that would be happy to contribute.
- DCMR – the environmental protection agency of the Province of South Holland and thirteen municipalities in the region of Rijnmond. TNO has been working with DCMR before and has contact persons in the organisation.

The intended date for the workshop is around April 2024 and it will take place at the TNO office in Utrecht.

During the workshop, experts on the topic from TNO will give a presentation on the topic (Source Apportionment, current developments, future work, and potential use cases). Furthermore, we will also invite (a selection of) attendees to present about their work and how they are currently using Source Apportionment or how they see potential use cases. Also needs and wishes for how (potential) users can best use the data will be discussed. This way we can all learn from each other. The aim is to keep it small, interactive, and invite discussions and sharing of insights.

1.3 Other communication efforts

Next to the workshop that is focused on user engagement, we are also planning to work on several other communication products. These focus more on outreach towards a larger audience. Based on recent discussions with the complete CAMS-NCP team and other experts in the field, we have come to the following ideas:



- 1) An infographic or folder on Source Apportionment. On this infographic we want to also highlight the collaboration between KNMI, TNO and potentially RIVM, as in the CAMS-NCP framework. The infographic would focus on potential use cases and opportunities.
- 2) A PowerPoint slide showing how CAMS creates and delivers information supporting the work of different organizations such as those in The Netherlands we are working with (KNMI, RIVM, TNO). This slide can be used by our consortium members in a multitude of presentations.
- 3) TNO organizes a yearly two-day workshop event: the LOTOS-EUROS user workshop. During this workshop, we plan that our partners mention the use of CAMS in mentioned products. We will report on this after the event. In the event, the modelling community comes together and learns about the applications of air quality models and data.
- 4) Writing an article for the newsletter of Dutch citizen science group 'Samen meten'. 'Samen meten' collects air quality measurements throughout the country and communicates about them.

We want to create an overview of the used CAMS products in The Netherlands: where are they used, who creates them, and who could potentially use them. Integrating the knowledge of collaborators on the other work package will allow us to create such an overview and include it in the final deliverable of this project. Additionally, it is our goal to create a communications product that explains the mentioned, for the partners and CAMS to use internally. Such an overview will include:

- a. An overview of the CAMS projects contributed to by our organisations. We will identify which products are created in these projects and for these products we want to identify current users. A first discussion on this is included in Chapter 2. We will elaborate on this and complete the overview in the remaining time of the project.
- b. An overview of the different CAMS services and potential users for these in the Netherlands. A first draft is included in Chapter 3 and we will continue to work on this.

1.4 Planning

Our current planning for the upcoming months is as follows:

December 2023: decide on who to invite for workshop and contact them.

January 2024:

- Create PowerPoint slide for widespread use by partner organisations
- TNO Lotos-Euros workshop: partners mention the use of CAMS productions and potentially highlight the collaboration within CAMS-NCP.
- Infographic or folder on Source Apportionment

March 2024:

- Finalize preparation for user engagement workshop

April 2024:

- User engagement workshop (exact date needs to be decided) (T7263)
- Article for newsletter of 'Samen meten'. It needs to be decided whether we want to publish this article before or after the workshop. Also, we need to check when these newsletters are distributed exactly.



August 2024:

- Deliverable for task Task 7264 and Task 7265 Development plan and communication strategy
- In this deliverable, we will include our overviews of CAMS products, services, current users and potential users in the Netherlands.



2. Existing users of CAMS products in The Netherlands – task 7261

For this task, we aim to make an overview of the existing users of CAMS products in The Netherlands. To do this, we first disseminate the current largest and already known users of CAMS in a stakeholder overview. As a second step, we want to create a table with the different CAMS projects running in the Netherlands that we are working on and include the CAMS products involved in these projects. This overview can serve as a stepping stone for a future overview that also includes CAMS projects that our partners (TNO, KNMI, RIVM) are not involved in.

2.1 Stakeholder Overview

2.1.1 National Institute for Public Health and the Environment (RIVM)

A key user of CAMS products in the Netherlands is the RIVM, the National Institute for Public Health and the Environment. The RIVM is the national institute in the Netherlands to monitor and communicate about air quality. Also, RIVM collects the official reporting of emissions in the Dutch emission inventory (*emissieregistratie*), they are the official institute to send out warnings about air quality, and they also model and measure different pollutants.

RIVM is the national government organisation in the Netherlands tasked to monitor current and upcoming air quality. RIVM issues air quality warnings and monitors when and where threshold concentrations of air pollutants are exceeded. These roles are assigned to RIVM by law. Therefore, important context for the communication about CAMS products to parties in the Netherlands, is the role of RIVM as assigned organisation for the national Air Quality monitoring and the national air quality warnings and forecasts in the Netherlands. Also, for (bottom-up) emission monitoring in The Netherlands RIVM is responsible together with several partner organisations in the framework of emission registration (<http://www.emissieregistratie.nl>)

Given their role, RIVM is a key user of CAMS products in the Netherlands. RIVM has been involved in this CAMS-NCP project from the start, and important CAMS-NCP communication efforts and strategies are defined through discussion and coordination with RIVM throughout the project. This is also to preserve the official role that the RIVM is tasked with, and to ensure that other parties are made aware of this fact. Joost Wesseling (RIVM) is currently mostly involved in CAMS-NCP. However, we will also involve other experts on specific topics when appropriate (e.g. Margreet van Zanten for emissions).

2.1.2 Other users

The RIVM is the main user of CAMS products in the Netherlands. However, other institutions also make use of different CAMS products. These vary strongly per topic and CAMS product, so we therefore grouped these.

Emissions products

CAMS emission products are used throughout different organisations in the Netherlands. Most modelling teams use the CAMS emissions as inputs. TNO, KNMI, and most other (University) research groups are users.



Air quality and source apportionment

In The Netherlands, several public entities are using source apportionment data. For example: the province of South Holland, the municipality of Eindhoven. They often already use the offline data, which is not a CAMS product. We believe they will also be interested in source apportionment from CAMS. The overall product includes targeted versions for users in The Netherlands. Targeted products are products more focused on the national and regional scale, at high resolution.

Other examples of current use of CAMS products and their downscaled versions, are small business in the Netherlands. These are mostly small businesses focused on air quality specifically, or data in general. One example is 'Zicht op Data' who use downscaled air quality and source apportionment.

Another example of this is *AIR-Portal*, a dashboard that provides high resolution insight into air quality problems. Together, the company Science & Technology (S[&]T) and KNMI have developed this air quality dashboard for urban areas, combining CAMS regional and global data, land use and local monitoring data into high-resolution air quality forecasts. These can be used in decision-making processes for cities and to inform the public about air quality on street-level scale.

2.2 Current CAMS projects and products in The Netherlands

It is important to have an overview of the CAMS projects and products running in The Netherlands. This allows us to better see which (types of) organisations are currently using the CAMS products and to better see opportunities for potential users or CAMS products. Table 1 contains an overview of the current projects, what products these projects result in, and what current and potential users are. This list focuses on the projects where either TNO, KNMI, or both, are involved, as this is what we have most insight in and what we want to focus our communication work on. These projects are all on Global and European scales. We aim to have a complete and up-to-date overview and understanding of the current CAMS and CAMS-related research projects by the end of our work on these work packages. The projects targeted are projects with a contribution of a Dutch partner (TNO, KNMI, RIVM).

Table 1. Current CAMS and CAMS-related research projects and contact persons.

Project	Product	Contact person
CAMS2-61: Global and European Emissions	Gridded emissions of air pollutants and greenhouse gases	Hugo Denier van der Gon (TNO), Peter Coenen (TNO)
CAMS2_71: Policy support service	source attribution of air pollution	Renske Timmermans (TNO), Dick Heslinga (TNO)
CAMS2_55: Provision of global inversion-optimized greenhouse	CH ₄ and CO ₂ emission fluxes, Greenhouse gas modelling	Arjo Segers (TNO), Dick Heslinga (TNO), Vincent Huijnen (KNMI)



gas fluxes and concentrations		
CAMS2_35: Provision of global atmospheric composition model support for the CAMS global forecasts, and analysis products	Support to tropospheric and stratospheric chemistry	Vincent Huijnen (KNMI), Jason Williams (KNMI)
CAMS2_40: CAMS Regional air quality forecasts and analyses	Air quality forecasts and analysis for Europe at ~10 km resolution. Including LOTOS-EUROS contribution TNO/KNMI task: Provision of Lotos-Euros contribution Forecasting using Lotos-Euros	John Douros (KNMI), Peter van Velthoven (KNMI), Renske Timmermans (TNO), Diane Pétillon (TNO)
CAMS2-82: Posterior validation of the CAMS global service components	Validation results for CAMS global service. KNMI task: Coordination	Nikos Benas (KNMI), Henk Eskes (KNMI)
CAMS2-83: Posterior validation of the CAMS-regional service above the surface	Validation results above surface for all CAMS regional models. KNMI task: Use of TROPOMI data for validation	Henk Eskes (KNMI)

As discussed before, we will focus the communication work on ‘Source Apportionment’, after which we want to create communication products for the ‘Air Quality Downscaling’ work. Both topics are the focus of our work in the other CAMS-NCP work package (WP Downscaling). However, this overview will highlight other potential focus topics. These potential new topics might integrate well to synergize with Source Apportionment or Downscaling. Another idea is to see if these new topics can form a base for us to include them in our communication efforts. This will be decided upon at a later stage.

Also, this overview will be useful as a (internal) communication product. During these analyses, we have found that for less experienced members to our organizations, it is often difficult to oversee what CAMS products different organisations in the Netherlands work on, as well as which are current or potential users. On the other hand, experienced colleagues have much knowledge about the exact contributions to different projects. Therefore, we want to work on extending this overview over the course of this project. Eventually we want to create a PowerPoint slide or infographic on this, that could be shared both internally and externally when discussing CAMS or related projects and products.



3. Potential users – task 7262

After having created an overview of existing users of CAMS data, we want to pinpoint potential new users of CAMS for us to target our communications to. To meet this goal, we have had several discussions with experts in the field and for inspiration we viewed the use case examples of CAMS on the Copernicus atmospheric website. This has given us more insight in the possible stakeholders and target audiences for our communication efforts.

Potential users of CAMS products consist of a large range of types of parties. In principle, every organisation doing work related to air quality or emissions could be interested in CAMS products. However, different CAMS products might attract different potential users. Here, we define several groups.

We will refine our communications to the potential user group and vice-versa. How we will finetune our exact target audience for the communication efforts will be decided over the upcoming weeks.

3.1 Provinces and municipalities, with a regional responsibility, and environmental agencies

Potential users: provinces, municipalities, environmental agencies

RIVM is the national organisation to send out air quality warnings when thresholds are exceeded and they also focus on national policy. During episodes when thresholds are crossed, it is mainly the responsibility of provinces to act and find measures to help improving air quality. These provinces often work closely together with environmental agencies. An example of this is DCMR, which is the environmental protection agency of the Province of South Holland and thirteen municipalities in the Rijnmond region. They are committed to a clear, healthy and safe living environment for its inhabitants and draw up environmental regulations for industries and other companies.

Organisations like DCMR are hired by local and regional authorities, and may be interested in using CAMS downscaled air quality analyses and forecasts, and source apportionment.

Municipalities, such as Eindhoven, with which we have worked, also have a responsibility in the realm of air quality. Therefore, municipalities could be potential users of CAMS products.

3.2 Health

Potential users: epidemiologists, IRAS, Longfonds, KWF, hospitals, GGD (public health services), health insurance companies?

Various health related organisation can be assigned as potential users of CAMS products. Epidemiologists may be interested in exposure maps, for which CAMS maps can be used.

Another potential user is IRAS, the Institute for Risk Assessment Sciences at Utrecht University. They focus on education and research on health risks of people in their (work-) environment or via food. They also study effects on ecosystems.



The Lung Fund (*'Longfonds'*) aims to eliminate lung diseases and to contribute to a healthier and happier life for people with lung disease. An important aspect for this is clear air, as it causes or worsens lung diseases. Similarly, the KWF (Dutch Cancer Society) aims to decrease the cancer and raise awareness on what increases risks, such as UV radiation or air pollution, which is where a series of CAMS products may come into place.

The GGD (Public Health Service) is also a potential user of downscaled air quality analyses and forecasts, as well as source apportionment. Their role is to inform and advice about air quality and health effects.

3.3 Businesses and start-ups

Potential applications of the CAMS data are smartphone apps giving free air quality forecasts or real-time updates on pollution. Examples are the CERC *airTEXT* and Plume Labs. Similar, but more focused, is PASYFO, a forecast of air quality focused on people suffering from pollen allergies. SunSmart Global UV App provides five-day UV and weather forecasts, highlighting time slots when UV radiation will peak. Other businesses that could be interested are organizations using satellite data, such as Planet that has its own satellite missions and that uses downstream earth observation data.

Other Dutch smaller companies active in the satellite and space domain are: Caeli (Amsterdam), ISISPACE Group (Delft), Geodata for Agriculture and Water (The Hague), FutureWater (Wageningen), eLeaf (Wageningen), 52impact (Rotterdam), Space4Good (The Hague), Skytree (Amsterdam), Satelligence (Utrecht), SarVision (Wageningen).

3.4 Other

OnePlanet is a research collaboration of multiple stakeholders: Wageningen University, Radboud University, Radboud academic medical center, and the nano-technology company 'imec'. They perform research, among others, in 'Precision agriculture, food & environment'. They could possibly use CAMS data through the use of TNO's source apportionment tool, or when finished, through the downscaling tool that is being developed by KNMI and TNO.

Some civil societies (general public) could potentially be interested in air quality information. Probably they will not be interested in satellite data sets, but possibly processed data into tools, such as the TOPAS source apportionment tool that we have here at TNO.

Climate Risk is a growing sector that, among other things, provides financial institutions and e.g. insurance companies with information about the stress that the changing climate is imposing on specific geographic locations. These organizations use satellite data. A Dutch example of such an organization is 'Climate Risk Services'.



Investment organizations or banks could use CAMS data when judging parties for sustainable investments. This might especially be the case now that organizations might be lawfully held accountable in the future. For example, in The Netherlands, investment organizations exist that focus on sustainable development, such as the semi-public organization InvestNL. This organization uses environmental data to assess their potential investments. Other Dutch banks focused on environmental sustainable wellbeing are ASN bank and Triodos bank. A private equity fund focused on environmental and social impact is Pymwymic. For some organizations, currently mostly bottom-up information is being used.

Weather companies

Smaller weather companies could use CAMS data too, for example the UV forecasting products. In The Netherlands, e.g. the meteorologist Gerrit Hiemstra (our former national news weather anchor) has set up Weather Impact specializing in climate change and the impact of weather events. We have reached out to this organization to ask about their data use. Another potentially relevant weather forecasting company is e.g. Weeronline. The identification of national and international weather companies on the Netherlands weather market will be completed by the end of the project.

Ministries

Our ministries might make use of (satellite) atmosphere monitoring data, e.g. for their communication and for policy support. In The Netherlands it is common for ministries to work together with external (commercial) partners on certain projects. It is important in this project to keep the ministries up-to-date and aligned on the potential of the available CAMS products and provide advice on their potential use to support government policies.

Policy consultancies

Smaller policy consultants might advise on policies based on the CAMS policy tools. Examples of such Dutch organizations are Metabolic (Amsterdam) and Twynstra Gudde (Amersfoort).

Table 2 is the framework for the overview of different potential users for various CAMS services. As discussed before (Chapter 1), we aim to fill this table and create a complete understanding and overview of potential user groups in the Netherlands for different CAMS services. This overview will allow us to easily identify potential user groups and interesting CAMS services for future communication efforts.

Table 2. Potential user groups and CAMS services

CAMS service	Potential user group	Remarks
Emissions and surface fluxes		
Source apportionment of European air pollution		



Regional Air quality forecasts and analyses		This also includes pollen.
Global air quality forecasts and analyses		
Greenhouse gas fluxes (emissions inverted from observations)		
Global CO2 forecasts		
Fire activity analyses		
Solar energy service (solar radiation products)		
Ozone layer and UV index forecasts		
Climate forcing		



4. Existing communications channels

We have also created an overview of existing communications channels in the Netherlands, for both CAMS products and air quality in general. This is based on discussions with different people in the field of air quality and involved in CAMS service products in the Netherlands.

In the past, NSO (Netherlands Space Office) has organised some workshops focusing on CAMS. It has however been a few years since their last event. We want to reach out to NSO to inquire about their communications and events surrounding CAMS.

4.1 Dutch social media channels of the biggest institutions in Air Quality and satellite data

TNO communications channels

Twitter/X: @TNO_nieuws (11.4K followers)

@TNO_Research (4K followers)

@TNO_pers (4K followers)

Instagram: @tno.innovation (3.7K followers)

LinkedIn:

@TNO (120K followers)

@TNO-duurzaam 'TNO sustainable' (6K followers)

@TNO-digitaal 'TNO digital' (5K followers)

@TNO-gezond 'TNO healthy' (3K followers)

@TNO-veilig 'TNO safe' (1.8K followers)

...and many, many more small TNO LinkedIn pages

Facebook: @TNO (14K followers)

...and many, many more small TNO FB pages

KNMI communications channels

***Twitter/X:* @KNMI (128K followers)**

LinkedIn: @knmi (13K followers)

Instagram: @knmi_nl (7.3K followers)

Facebook: @KNMInl (5.2K followers)

RIVM communications channels

***Twitter/X:* @rivm (229K followers)**

***Instagram:* @rivmnl (73K followers)**

LinkedIn:

@RIVM (63K followers)

@rivm-gezond-leven 'RIVM Healthy Living' (17K followers)

@rivm-en 'National Institute for Public Health and the Environment' (800 followers)

***Facebook:* @RIVM (231K followers)**

Other air quality communications channels:

SRON Netherlands Institute for Space Research

Twitter: @SRON_Space (2.4K followers)



Instagram: -

LinkedIn: @sron (6K followers)

Facebook: @SRON.nl (1.4K followers)

NSO Netherlands Space Office

Twitter/X: @NLSpaceOffice (2.6K followers)

Instagram: -

LinkedIn: @nso---netherlands-space-office (7K followers)

Facebook: -

An interesting take-away is that these institutions sometimes have huge followings on different types of social media, and low followings on other types of social media. None of these groups engage in TikTok communications, as was found. The largest communications channels are, in order from largest to smallest: the RIVM twitter/X account (229K), the RIVM Facebook account (231K), the KNMI twitter/X account (128K), the TNO LinkedIn account (120K), the RIVM Instagram account (73K), the RIVM LinkedIn account (63K). We do not know about the engagement on any of these websites. It is also interesting that TNO holds a large variety of small LinkedIn accounts.

These largest channels could very well be used for communications that fall within this project with a mention of the use of CAMS data. Such a post could well be manufactured to fit on the TNO LinkedIn account, for example.

4.2 Other channels

Another way to distribute information is in the newsletter of the citizen science group: 'Samen Meten'.

A piece of text can be created to communicate on our TNO website, which could be linked to by the social media channels with the main take-away. We will be in touch with the TNO communications department about this.

We will inquire with the TNO communications team about potential other suitable media sources.



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