Annual Animal Welfare Report 2023

23rd issue

Abbreviations

3Rs	Replacement, reduction and refinement of tests that use animals[1]
4Rs	Replacement, reduction, refinement and responsibility principles[2]
CLP	Classification, labelling and packaging
ECHA	European Chemicals Agency
EOGRTS	Extended one-generation reproductive toxicity study
HESI	Health and Environmental Sciences Institute
NAM	New approach methodologies
NGRA	Next-generation risk assessment
OECD	Organisation for Economic Co-operation and Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SMEs	Subject-matter experts
TCW	Well treatment, completion, and workover fluids
TIE	Toxicity identification evaluation
UVCBs	Substances of unknown or variable composition, complex reaction products or biological materials
WET	Whole effluent toxicity

1) Russell and Burch. The Principles of Humane Experimental Technique (1959).
2) Lee KH, Lee DW & Kang BC. The 'R' principles in laboratory animal experiments (2020).

Introduction from Shell's VP Carbon & Environment

"During 2023, we made significant progress in enhancing the welfare of animals within our operations and supply chain."

I am pleased to share with you the annual Animal Welfare Report 2023. I am proud to highlight how our commitment to animal welfare is a vital part of our broader sustainability strategy. Our efforts in this area are not only ethically important but also essential for building a resilient and responsible business.

During 2023, we made significant progress in enhancing the welfare of animals within our operations and supply chain. Our initiatives to improve living conditions for animals reflect our dedication to ensuring they are treated with the utmost care and respect. By creating environments that promote natural behaviours, we are enhancing their well-being and setting higher standards for the industry.

Our supplier relationships are crucial. We have implemented stringent animal welfare standards and conduct regular lab visits to ensure compliance. This rigorous approach ensures that our partners share our commitment to humane treatment and continuous improvement.

Innovation is at the heart of our animal welfare efforts. We continue to adopt new practices and technologies that enhance the care and treatment of animals. This includes developing alternative methods to reduce reliance on animal testing.

Our advocacy for reducing the number of animals used in safety assessments is particularly important in our interactions with regulatory bodies like the European Chemicals Agency (ECHA). We are committed to working closely with the ECHA to promote and support the use of alternative testing methods that avoid the use of animals. By engaging in dialogue and collaboration with regulatory authorities, we aim to drive the adoption of these alternatives, ultimately reducing the reliance on animal testing across the industry.

Transparency and accountability are fundamental to our approach. Our detailed reports provide insights into our practices, progress, and the impact of our initiatives. We demonstrate our commitment to continuous improvement and ethical practices by sharing specific metrics and success stories. Looking to the future, we have adapted animal testing into Shell's Performance Framework. By fostering a culture of compassion and responsibility, we aim to lead the industry in ethical practices and contribute to the global movement towards cruelty-free research and development. These efforts are integral to our overall sustainability strategy and reflect our commitment to creating a more humane and sustainable business. I invite you to review the full report to learn more about our efforts and achievements over the past year. Thank you for your continued support as we strive to lead the industry in animal welfare.

Karen Benetti
Vice President Carbon & Environment

About this report

"Shell has been voluntarily reporting the number of activities involving laboratory animals for more than 20 years."

Shell has an ethical duty to ensure that the animals under our care are treated according to the Five Domains Model of animal welfare[1]. Animal welfare, as an integral component of the One Health[2] framework, recognises the interdependency of human, animal, and environmental health. With a strong sense of duty in mind, Shell is committed to prioritising animal welfare in all aspects of its operations.

Shell has been voluntarily reporting the number of activities involving laboratory animals for more than 20 years. This is Shell's 23rd Animal Welfare Report, and it serves as a comprehensive overview of our efforts and progress in safeguarding the welfare of animals. It covers a wide range of activities and initiatives, using the 4Rs principles as a control hierarchy, as defined below:

Replacement: Shell is committed to replacing animal testing with advanced technologies like in-vitro and in-silico modelling, reducing animal use and enhancing research relevance.

1) (Mellor et al., 2020.) The 2020 Five Domains Model: Including Human-Animal Interactions in Assessments of Animal Welfare.

2) Goetschel. Animal welfare as the basis of One Health: A UN convention on animal welfare, health, and protection poses a realistic solution to improved animal welfare and human health. CABI One Health (2024) 3:1

Reduction: Shell is committed to reducing animal use through strategic study design, statistical rigor, and data sharing. By fostering collaboration and cost sharing, Shell minimises redundancy and unnecessary experiments, ensuring high-quality research.

Refinement: Shell prioritises continuous improvement in experimental procedures to minimise animal distress. Over the past year, Shell updated its standards to enhance animal welfare. Through training and facility visits, staff are empowered to adopt best practices in animal care, ensuring studies are conducted only in approved facilities.

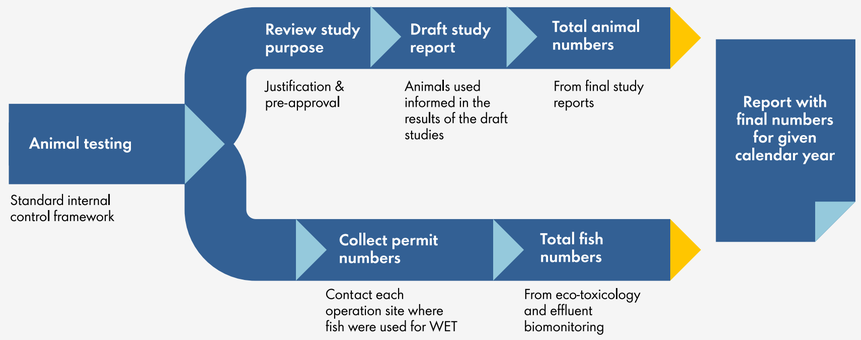
Responsibility: Shell acknowledges its duty to consider the societal and ethical implications of its actions on animal welfare. Committed to transparency, accountability, and ethical integrity, Shell ensures these values guide its operations, from research to community engagement.

Before conducting any study involving vertebrates that is not for permit-mandated effluent biomonitoring, an internal justification and approval process is required. The process involves reviewing the study's purpose, animal numbers and species, and ensuring no New Approach Methodologies (NAM) are available. Applied 4Rs principles are compared to standards like the Organisation for Economic Co-operation and Development (OECD) guidelines. The study starts after internal review and approval, with the final animal count shown in Shell's annual Animal Welfare Report (Figure 1). This figure shows the workflow to identify the number of vertebrates animals tested. The data comes from product tests and from discharge permit required tests.

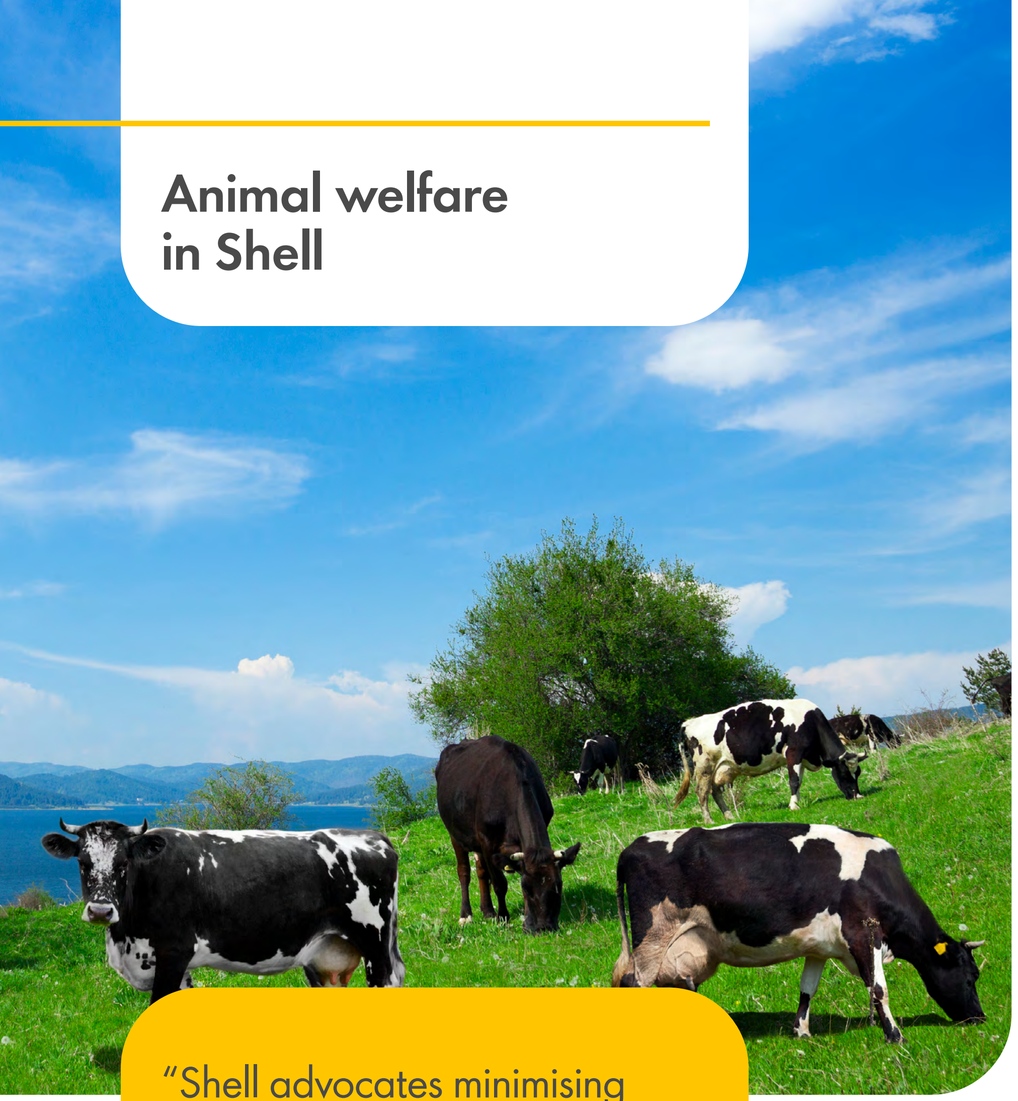
An external Animal Welfare Panel reviews Shell's animal testing requirements twice a year, advising on the 4Rs application. Details about the Panel's membership and terms of reference are in the report's Panel membership section.

The panel reviewed this report, advised on animal welfare, and provided feedback on the 4Rs. Shell is committed to advancing science, promoting ethics, and advocating for animal well-being. Overall, Shell invites stakeholders, partners, and the public to join in its journey towards a sustainable world for both animals and humans.

Figure 1. Workflow diagram representing the animal welfare control framework and report production



Animal welfare in Shell



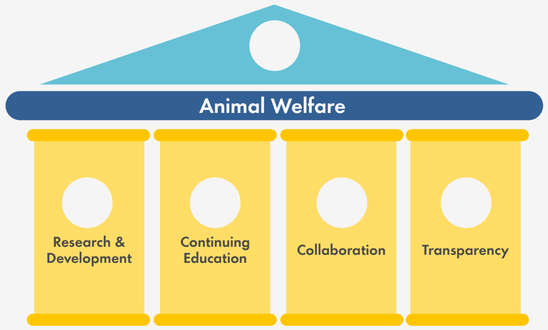
"Shell advocates minimising animal use while ensuring chemical safety."

Shell uses animal testing to comply with regulations that control chemical hazards and risks to humans and the environment for example, Regulator, Evaluation, Authorisation and Restriction of Chemicals (REACH) in the European Union (EU), Environmental Protection Agency in USA. Current regulations often require animal testing to assess chemical hazards, regardless of exposure or risk. Frequent updates to regulations and test methods may increase the number of animals needed for testing, as previous studies might become outdated or new hazards might need evaluation.

Committed to chemical safety, Shell believes in finding more effective, relevant, and ethical methods than animal testing. The aim is to assess safety without harming animals by leveraging existing scientific knowledge and alternative approaches. Shell advocates minimising animal use while ensuring chemical safety. Regulatory frameworks like REACH require consistent animal testing protocols. However, a strict interpretation of these requirements may focus too narrowly on the tests themselves rather than the ultimate goal of safety. By focusing on the outcomes of chemical safety assessments, Shell can explore alternative methods and promote animal welfare.

Shell has a focused, comprehensive animal testing strategy based on four pillars that promote the principles of the 4Rs and guide the mindset and behaviour of Shell's subject matter experts (SMEs). SMEs prioritise their objectives based on Shell's commitment to evaluating human and environmental safety. They also focus on identifying and overcoming any impediments to implementing the 4Rs in animal testing. The animal welfare pillars in Shell are shown in Figure 2. The four pillars include research & development, continuing education, collaboration and transparency.

Figure 2.
Animal Welfare Pillars in Shell



Illustrative cases of Shell's four pillars on animal welfare standards

Research and development

Using marine invertebrates as an alternative to fish for assessing discharge risk.
The Gulf of Mexico discharge permit was updated in 2023 and included new toxicity testing requirements for Well Treatment, Completion, and Workover Fluids (TCW). To determine if Shell's discharges would meet future permit compliance, Shell performed tests on commonly used TCW fluid discharges. A joint industry study that Shell was a part of on TCW discharges from 2019-2022 indicated that TCW discharges are more sensitive to invertebrates, so the internal pre-permit preparedness study was performed on marine invertebrates (Americamysis bahia – mysid shrimp) instead of fish. In total, 97 pre-permit tests were performed on mysid shrimp, which resulted in more than 23,280 fish not being used.

4Rs impact: Using appropriate marine invertebrate-testing during discharge assessments can help to reduce the number of vertebrates used in testing, aligning with the principle of reducing the overall use of animal testing. The R of replacement is also applied in this case because many invertebrates have simpler nervous systems than fish.

Research and development – collaboration

Collecting information from discarded skin tissue.
Shell is exploring opportunities to advance the knowledge of the use of paraffin oils in vaccine adjuvant formulations. For this purpose, a protocol for tissue sampling has been developed based on previous years of work with rodents. This protocol aims to collect biological samples for chemical analysis to understand how the oil behaves at the exposure site. In collaboration with a partner organisation, Shell conducted a research study on discarded tissue from their experiments in rodents to advance its understanding of the oil used as a vaccine adjuvant in vaccination trials.

4Rs impact: This co-development approach allows Shell to bring its years of expertise on oil composition and analytical chemistry while maximising the use of its partners' biological samples, which would otherwise be discarded or not considered for assessment. In this way, Shell reduces the need for new animal testing.

Research and development – collaboration and transparency

Decision withdrawal by ECHA.
In 2023, the ECHA requested an Extended One-Generation Reproductive Toxicity Study (EOGRTS) on rats for xylene isomers. The study should include cohorts 1A and 1B for reproductive toxicity, cohorts 2A and 2B for developmental neurotoxicity, and investigate learning and memory function. It should last 10 weeks and use the EU B.56/OECD TG 443 test method. According to the ECHA, the highest dose level should be determined based on evidence of adverse effects on sexual function and fertility – which can unfortunately produce severe suffering or death in the animals. Therefore, Shell, BASF SE, and Compañía Española de Petróleos S.A.U. contested a decision through the Board of Appeal process, requesting to exclude the extension of the EOGRTS to cohorts 2A and 2B and investigations on learning and memory function. The Agency's Executive Director withdrew the decision, and the appeal was withdrawn, resulting in the case being closed at the end of June 2023.

4Rs impact: As a result of this appeal, the number of animals required for testing was reduced by approximately 10,000. This case demonstrates that regulatory agencies can reconsider decisions after appeals, especially if legal and scientific arguments are presented regarding the use of laboratory animals.

Continuing education – collaboration

Chronic fish alternatives.
In 2023, a new scoping group was formed to explore alternatives for chronic fish tests. A workshop on "Alternatives to Chronic Fish Toxicity Testing" was held in Paris, attended by 35 scientists from 12 countries, including one from Shell. The workshop aimed to develop a strategy for alternative approaches to assessing chronic fish toxicity, with a focus on enhancing environmental protection capabilities. Expert work groups will follow up on specific projects to advance fish NAMs.

4Rs impact: By focusing on NAMs, this type of training aims to replace and reduce the use of live fish in toxicity testing. Subsequently, standardised NAMs for assessing chronic toxicity to fish can increase regulatory acceptance and promote the 3Rs principle in regulatory frameworks.

Continuing education – transparency

World Animal Alternatives Congress (WC12) Niagara Falls, Canada, August 2023.
Shell was invited to speak at the World Animal Alternatives Congress in Canada, co-hosted by Health Canada and Environment Canada. The conference, with about 900 attendees, included a session on transparency in advancing animal alternatives, where Shell presented a summary of its 20-year animal welfare program. Shell emphasised the need for alternatives to fish testing in effluent testing in the USA and Canada, its largest vertebrate use. The presentations were well received, and connections were made with the Animal Free Safety Assessment (AFSA) consortia to join their project to develop an animal-free approach to determine CLP/GHS (classification, labelling and packaging / Globally Harmonized System of Classification and Labelling of Chemicals) without fish testing (Fish IATA program). Additionally, Shell learned about various animal use databases to augment its own animal welfare program.

4Rs impact: Producing a transparent report on animal testing over the last 20 years is evidence of the R of responsibility and contributes to efforts to improve ethical standards and animal welfare in science and for regulatory purposes. Furthermore, a retrospective analysis of the collected data supports additional strategies in the refinement of animal use and procedures.

Continuing education – collaboration

HESI UVCB Workshop Reykjavik, Iceland, September 2023.
Shell is part of the Health and Environmental Sciences Institute's Substances of unknown or variable composition, complex reaction products or biological materials (UVCB) committee, and organised the 2023 workshop. UVCB risk assessment is difficult due to its complex nature. Approximately 25% of chemicals in commerce, including most of Shell's, are UVCBs, which adds complexity to registrations. Therefore, Shell is committed to improving testing methods. The workshop achieved consensus on UVCB risk assessment and identified actions for improvement. Shell has a long-standing participation role on the HESI UVCB committee, aiming to enhance UVCB risk assessment.

4Rs impact: A collaborative case involving the development of NAMs for UVCBs regulatory purposes advancing on the R of replacement, leading to more ethical animal testing practices.

Research and development – continuing education

SETAC Latin America Meeting, Uruguay, September 2023.
The Society of Environmental Toxicology and Chemistry (SETAC) Latin America meetings bring together environmental professionals from various sectors in the region. Approximately 650 people attended the meetings, and sessions were focused on developing principles and practices for environmental-quality management. In a session on NAMs, Shell presented case studies demonstrating the use of predictive models for hazard assessments. The outcome was a strategy for advancing the development and adoption of NAMs to support chemical assessments.

4Rs impact: Multidisciplinary initiatives aimed at developing alternative methods for regulatory purposes are crucial. They not only promote the 4Rs principle but also play a vital role in driving the evolution of more ethical and sustainable practices in animal testing.

Continuing education - collaboration

NAMs for Toxicology postgraduate training, the Netherlands, December 2023. Wageningen University & Research introduced a new course on NAMs in its Postgraduate Education in Toxicology Program, including a training session by Shell on the practical applications of NAMs in evaluating UVCB substances for human and environmental safety. The module was developed as part of Shell's collaboration in the VHP4Safety (Virtual Human Platform for Safety Assessment) project and was designed to provide training to 18 participants in applying NAMs for hazard assessment and highlighted the importance of implementing these methods in practice.

4Rs impact: This training exemplifies the principle of responsibility by illustrating Shell's dedication to animal welfare. It highlights the measures Shell has adopted to minimise animal usage and educates students on techniques and protocols that newly emerging toxicologists can incorporate into their professional careers.

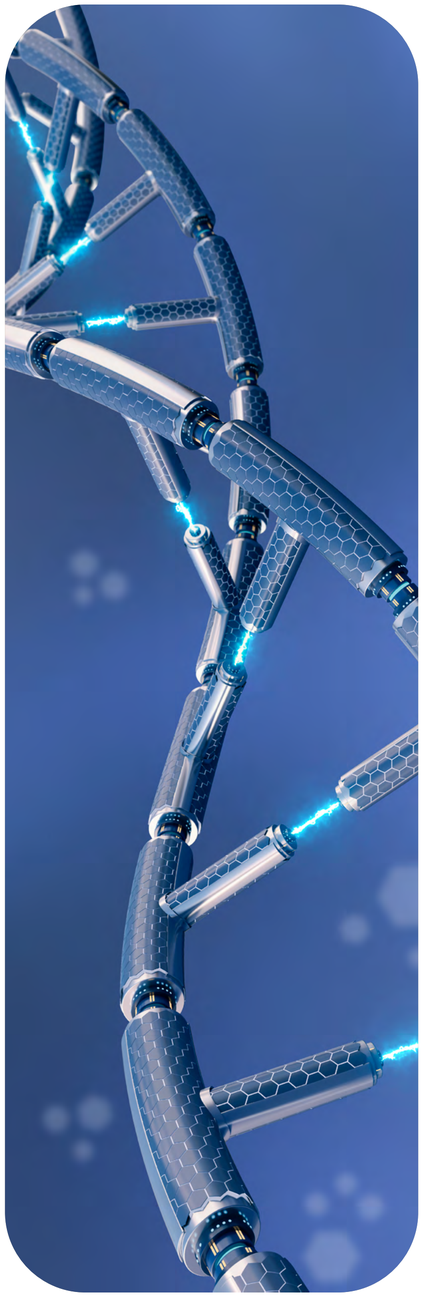
Research and development – continuing education and transparency

Animal welfare and the energy transition. Shell is using waste biomass and bio components from animals bred for food or feed production as low-carbon fuel feedstocks. We are producing renewable diesel and Sustainable Aviation Fuel (SAF) from rendered animal fats and transforming livestock manure into RNG (renewable natural gas - biogas). Shell is committed to exploring new uses of animal byproducts to meet energy demands while prioritising animal welfare and working with the Animal Welfare Panel to ensure adherence to animal welfare principles.

Dairy biomethane
In the USA, Shell operates four biomethane facilities that process dairy cattle manure to provide low-carbon biomethane for road transport. Shell works with its suppliers and partners with the National Dairy Farmers Assuring Responsible Management (FARM) Animal Care program to ensure animal welfare. FARM Animal Care is compliant with the ISO standard TS 34700 and updates its standards every three years. The latest version, FARM Animal Care Version 5, is expected to be adopted in 2024.

HEFA biofuel
Shell's hydro-processed esters and fatty acids (HEFA) and co-processing technology effectively convert crop oils, such as rapeseed oil, animal fats (tallow), and waste feedstocks (for example used cooking oil) into a diverse range of low-carbon fuels, including renewable diesel and SAF. Shell is committed to sourcing biocomponents that adhere to recognised and credible multi-stakeholder voluntary sustainability standards, such as the Roundtable on Sustainable Biomaterials and the International Sustainability and Carbon Certification, to ensure the purchased tallow meets animal care and welfare principles. In order to ensure the best possible treatment of animals in its supply chain, Shell is committed to collaborating with renderers and suppliers to enhance animal care and welfare standards. Shell's Animal Welfare Panel provides valuable feedback and guidance to strengthen its animal welfare initiatives. Shell remains dedicated to playing a positive role in advancing animal welfare in agriculture, mirroring the strides it has already made in animal testing.

4Rs impact: Shell is dedicated to enhancing animal welfare standards, and this initiative represents a significant advancement in refining its practices, which are in line with the principle of responsibility.



Statistics: Shell's animal testing 2023

"In 2023, Shell used 58,738 animals in research and testing... this would represent 0.73% of the EU's aggregate."

Shell reports on the activities of Shell-owned and Shell-operated companies. Any animal testing conducted by consortia in which Shell or its operated joint ventures participate is reported separately in this document. Shell provides comprehensive reporting on all animal testing, irrespective of whether the assay is performed in conjunction with other companies through industry consortia.

Table 1 presents the number of vertebrates used in procedures from 2019 to 2023. In 2023, the total number of vertebrates, which includes mammalian, fish and bird species, was 58,738. While this figure is lower than the 68,277 recorded in 2022, it is more than double the numbers reported in 2021. Notably, most vertebrates used were due to regulatory compliance in Europe and regulatory-mandated effluent testing in the USA and Canada.

Table 1. Number of animals used per year by Shell worldwide, 2019 – 2023

Animal used	Test commissioned by	2019	2020	2021	2022	2023
Fish	Shell	35,800	22,596	21,238	40,437	34,844
	Industry consortia	0	8,660	2,080	2,480	0
	JVs	780	720	720	1270	720
Rodents	Shell	215	0	90	1355	10
	Industry consortia	547	4,964	2,202	17,509	21,259
	JVs	0	0	0	0	0
Rabbits	Shell	6	3	0	684	0
	Industry consortia	6	3,178	1,214	4,542	1,277
	JVs	0	0	0	0	0
Birds	Shell	0	0	0	0	628
Total		**37,354**	**40,121**	**27,544**	**68,277**	**58,738**

Explanatory notes:

Industry consortia are groups of companies (including Shell) that cooperate, usually within the framework of an industry trade association, to share available data and the costs of testing programmes on particular chemicals or groups of chemicals.

Joint ventures (JV) include JVs where Shell has operational control. In instances where work was placed for a JV through an industry consortium, the data are reported under industry consortia.

Historically, the animals most commonly used for ecotoxicological testing in Shell are fish. After fish, rodents and rabbits are the next most frequently tested species. In 2023, there has been a decrease in the number of fish, rodents, and rabbits used exclusively by Shell.

Figure 3 highlights the increase in non-fish animal testing performed either via consortia and by Shell since 2019. Figure 3 shows the relative percent of fish and non-fish vertebrate testing reported and shows the trend over the past 5 years. The number of non-fish animals now makes up nearly 40% of the total animal testing population, a significant rise from the historical range of 10-20%. This change aligns with the increasing regulatory pressure by EU regulators to fully comply with testing requirements - which tend to include significant non-fish animal testing for substances registered at the highest tonnage category.

Fish have consistently accounted for 80-90% of the total animals used by Shell per year between 2010-2021. In 2022, however, the use of fish accounted for 65%. The proportion (61%), a shown in Figure 4, was even lower in 2023 (Figure 4). Figure 4 shows the percentage of birds, mammals and fish reported in 2023. This may be an indication of the increased regulatory pressure to provide non-fish animal testing data for various chemicals and products.

In 2023, Shell's and consortia vertebrate testing was predominantly due to REACH regulatory requirements or effluent testing (whole effluent toxicity - WET) (Figure 5). This figure shows the total number of vertebrates tested by application category (REACH, WET and other). A small number of vertebrates (~1%) were used for testing for other purposes (e.g., R&D). This is further evidence that regulatory requirements are the primary driver of animal testing in Shell and the wider industry in general. Moreover, testing was primarily conducted through industry consortia, which represented 99.9% of mammalian testing in 2023, up from 91.5% in 2022.

Why are fish the most commonly used species in Shell's animal testing?

In 2023, Shell's use of fish was predominantly driven by its adherence to discharge permit requirements in the USA and Canada, as well as to requirements relating to the disposal of hazardous waste in California (WET requirements). All fish used in 2023 were used exclusively for regulatory compliance, with 98% allocated to meet WET requirements.

Figure 3. Fish vs non-fish vertebrate usage from 2019-2023

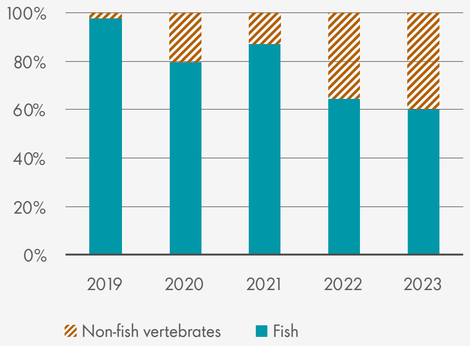


Figure 4. Types of vertebrates used for animal tests in 2023

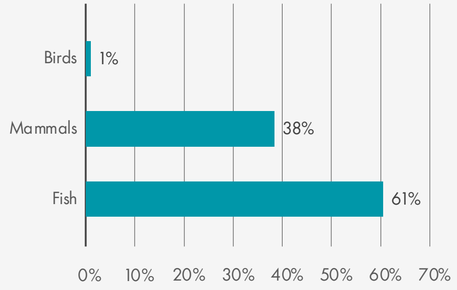
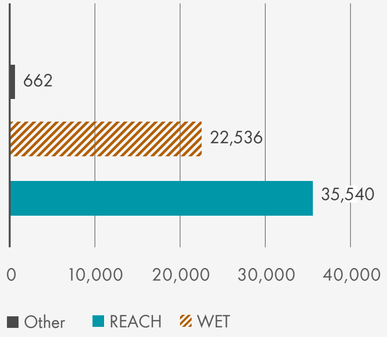


Figure 5. How vertebrates were used in animal tests in 2023



More than 99% of the total number of fish used by Shell over the past five years were for regulatory compliance (Table 2).

In 2023, the number of fish used for ecotoxicological testing declined by nearly 9,000 compared to 2022. The primary reason for the decrease was a reduction in effluent testing in Nigerian assets. While testing in Nigeria accounted for 20,000 fish in 2022, such mandatory testing is conducted only every three years. Fish use would have been even lower in 2023, but WET testing at a Canadian facility necessitated further Toxicity Identification Evaluation (TIE), requiring the use of an additional 3,840 fish.

What was the purpose of non-fish animal testing in 2023?

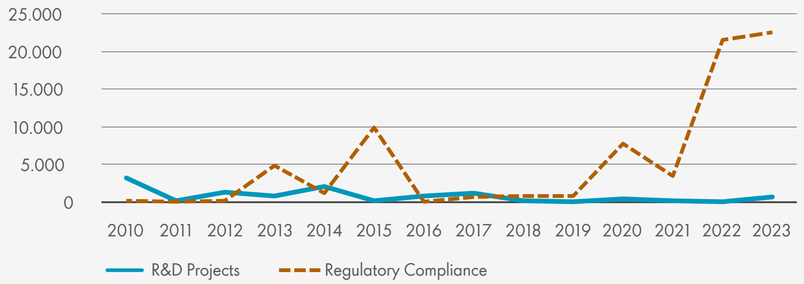
Shell outlines two main purposes for animal testing: regulatory compliance and research and development. In order to ensure compliance, it may be necessary to comprehensively collect data relating to the suspected toxic mechanism of action. An understanding of the toxic mechanism of action is vital in determining the relevance of test results obtained from animal models for human risk assessment. This knowledge is essential in accurately predicting the safety and efficacy of new chemicals or other substances, and can be used to enhance the quality of lab animal studies. In 2023, there was a 4.7% increase in the number of non-fish species used for regulatory compliance compared to 2022 (Figure 6). Figure 6 shows the trend of non-fish vertebrate use from 2010 to 2023 for R&D and regulatory compliance.

Table 2. The number of fish used for ecotoxicological testing in Shell or for Shell operations between 2019 - 2023

Purpose of testing	2019	2020	2021	2022	2023
3Rs and Research*	450	106	0	1,860	0
Regulatory compliance	36,130	31,870	24,038	42,327	35,564
Total	**36,580**	**31,976**	**24,038**	**44,187**	**35,564**

*) 3Rs and research: data is required to understand the health and environmental hazards of a product and is not collected for direct regulatory purposes. This testing is also performed to help Shell understand the potential implications of anticipated future regulatory requirements or applications for new permits (discharges).

Figure 6. Overview of Shell and Shell JV-conducted testing in non-fish species from 2010–2023 by purpose



Since the implementation of REACH, approximately 85% of all non-fish used for regulatory tests worldwide were solely for REACH compliance purposes since (Figure 6). However, over the last decade, the number of mammalian animals used for testing in other regulatory frameworks has significantly decreased compared to the testing performed for REACH. The data derived from REACH demonstrates its suitability as an acceptable solution for other global regulatory jurisdictions. This can be attributed to the use of specific parameters for global regulatory purposes, thereby reducing the need for supplementary testing following the conclusion of a REACH study.

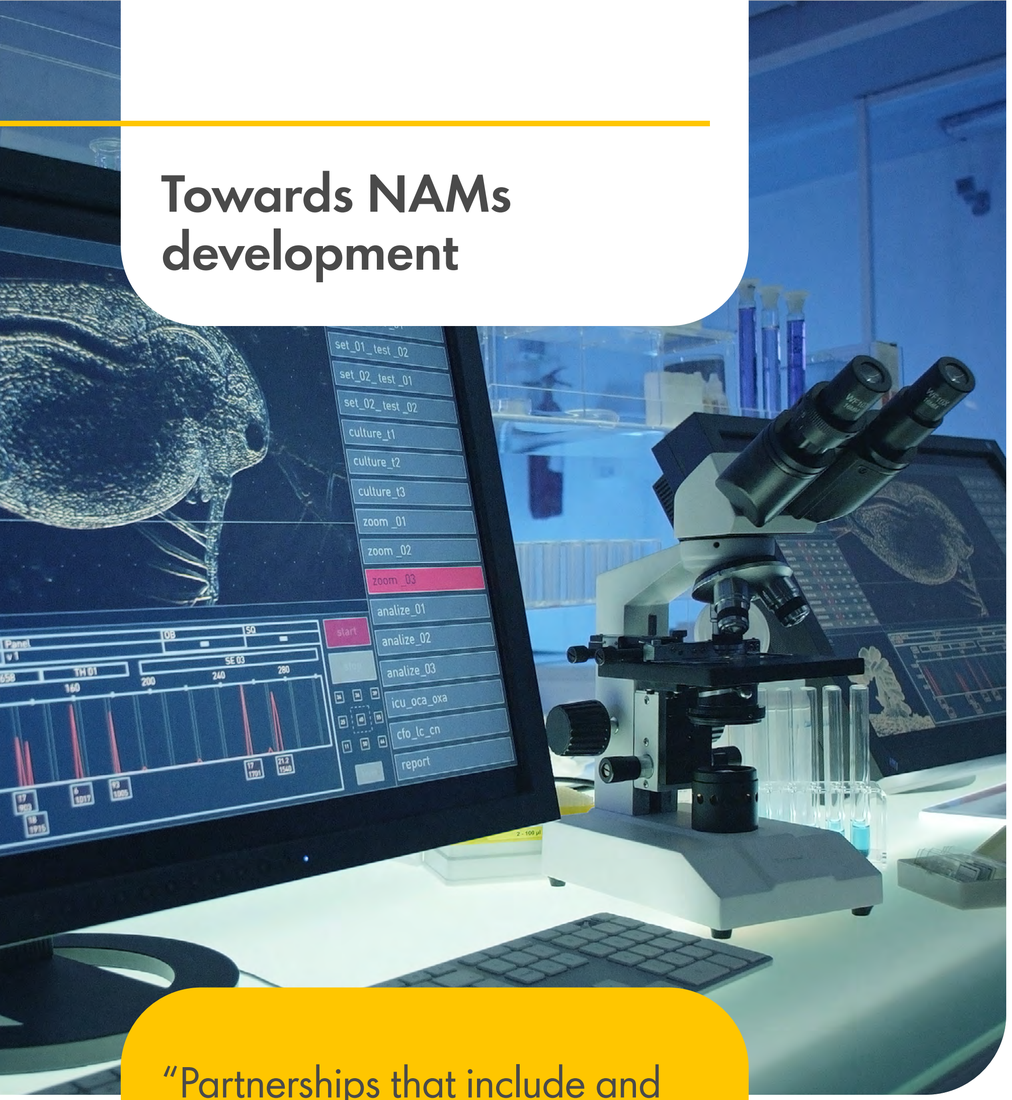
A small fraction of the non-fish test animals used in 2023 were used for research and development purposes. The objective of this research and development was to improve the formulation of vaccine adjuvants, with the aim of developing advanced methodologies to enhance its effectiveness. Overall, the resulting advancements are expected to significantly contribute to animals' well-being.

Proportionally smaller use

In 2023, Shell used 58,738 animals in research and testing (Table 1). While not a perfect comparison, this would represent 0.73% of the EU's[1] aggregate of 8.05 million animals recorded in its most recently published report in 2020 (for first and any subsequent reuse). When it comes to testing for regulatory purposes alone, Shell's number of animals tested in 2023 (58,110) would represent approximately 4.14% of the EU-wide use (1,404,420) for the same purpose.

1) Number of animals reported for 2020, covering the 28 countries (EU-27 and Norway). Published on 03-04-2023.

Towards NAMs development



"Partnerships that include and engage several stakeholders and that share common interests are beneficial to NAMs development."

Shell upholds the 4Rs principles in its testing strategies to ensure the welfare of animals. In cases where animal studies are mandatory to meet regulatory requirements, we seek to identify opportunities to combine mandated studies with NAMs. Therefore, Shell has been focusing efforts on collaboration towards NAMs development.

A recent survey of 18 product stewardship SMEs within Shell found that NAMs are already widely used across science disciplines to support activities within their areas. Apart from using NAMs, most SMEs have been involved in activities related to developing, using, advocating, and accepting these methods. However, only a few of them have direct experience of developing these tools. Additionally, the survey results are clear – external partnerships are crucial for advancing NAMs that can benefit Shell's product safety assessments.

Therefore, collaborating with external partners, including regulatory consortia, is an effective way to leverage financial and employee resources to advance NAMs. Strategic external partnerships must nonetheless be aligned with product stewardship priorities to achieve the desired results. Collaboration with different stakeholders, particularly regulators, is critical to ensure product safety and acceptance. Such partnerships not only improve the effectiveness of NAMs development but also create a transparent and inclusive process.

Partnerships that include and engage several stakeholders (particularly regulators) and that share common interests are beneficial to NAMs development. Consistently, many of the ongoing NAMs activities involving Shell product stewardship SMEs are carried forward through external organisations. As a result, and as described in the section on Illustrative cases of Shell's four pillars on animal welfare standards, Shell's SMEs have been collaborating with external agencies to develop new NAMs.

Shell has been actively participating in meetings with regulators, authorities, academia, and representatives from other industries to discuss the continued development and implementation of NAMs. In December 2023, its industry representative participated in a workshop organised by the European Commission focused on guiding principles of a proposal for implementing Next-Generation Risk Assessment (NGRA) in EU chemicals legislation. The agenda of the workshop included the development of a roadmap towards phasing out animal testing for chemical safety assessments.

Conclusions

In this 2023 Animal Welfare Report, Shell emphasises the importance of the 4Rs in relation to animal testing – the 3Rs principle and the R of responsibility. Likewise, the four pillars forming the foundation of Shell animal testing are crucial for maintaining a culture of care and good practice. As part of its commitment to the 4Rs, Shell promotes the investigation and use of NAMs and the use of existing data to minimise the need for animal testing.

As in previous years, most animals in 2023 were used for regulatory compliance, specifically fish and mammals. However, the overall amount of animal use is small compared to the total number of animals used in the EU[1].

The EU's REACH has been a crucial regulatory framework that has mandated studies on vertebrate species in recent years. Although the number of studies remained stable for a while, Shell's studies performed on animals have significantly increased since 2020, mainly because of increased requests for animal-intense studies under REACH. As of the end of 2020, the ECHA has mandated additional testing for systemic, reproductive, and developmental toxicity markers. Regulatory determination of developmental toxicity necessitates testing in rodent species and in non-rodent species, depending on the so-called tonnage band[2]. However, in 2023 Shell proved that advocating a reduction in animal testing may be a suitable course of action in situations where the requested investigation lacks a valid legal and/or scientific basis.

Shell has identified many benefits of joining consortia in animal testing. By pooling resources and coordinating efforts, it can avoid duplicating studies and share best practices, leading to a reduction in total animal use across the industry. Knowledge sharing within consortia can also create opportunities for read-across approaches[3], which can fill gaps in data and suggest additional ways to reduce animal testing for registered products. This coordinated approach to animal testing represents a promising pathway towards more responsible and sustainable practices across the industry.

In terms of research and development, Shell has conducted animal studies to develop vaccine adjuvants for animal health. This approach aims to promote animal welfare by preventing disease, reducing suffering, and supporting the health and well-being of animals in agricultural and veterinary settings.

Finally, as chemical regulations continue to evolve, the potential for an increase in animal testing cannot be ruled out. In such situations, Shell has been seeking to further improve animal welfare practices, including animal care and husbandry, to minimise the impact on animal well-being. As Shell looks to the future, it is vital for Shell and its stakeholders to keep working together, embrace emerging technologies and methodologies, and adhere to the highest standards of compassion and responsibility towards animals. Shell's commitment to animal welfare, in alignment with the One Health global framework, promotes a holistic approach to health that benefits animals, humans, and the environment, advancing in a sustainable and healthy future for all.

"Pooling resources and coordinating efforts can avoid duplicating studies and encouorage the sharing of best practices, leading to a reduction in total animal use across the industry."

1) Summary Report on the statistics on the use of animals for scientific purposes in the Member States of the European Union and Norway in 2020. Commission Staff Working Document. European Commission.

2) Tonnage band: range of quantities in which a substance is manufactured or imported annually.

3) Approach used to predict properties of one substance (the "target" substance) by using relevant information from similar substances (the "source" substances).

About the panel

"The Panel offers autonomous scientific expertise to Shell, drawing on the latest scientific research and knowledge in the field."

In 2001, Shell formalised its practices on animal testing by creating a more structured management process and by better communicating its position internally and externally. An external panel was also established in 2001 to provide independent scrutiny of and support for Shell's activities in this area.

Purpose

The external Animal Welfare Panel is part of Shell's management and assurance process for animal testing and welfare. The panel offers autonomous scientific expertise to Shell, drawing on the latest scientific research and knowledge in the field.

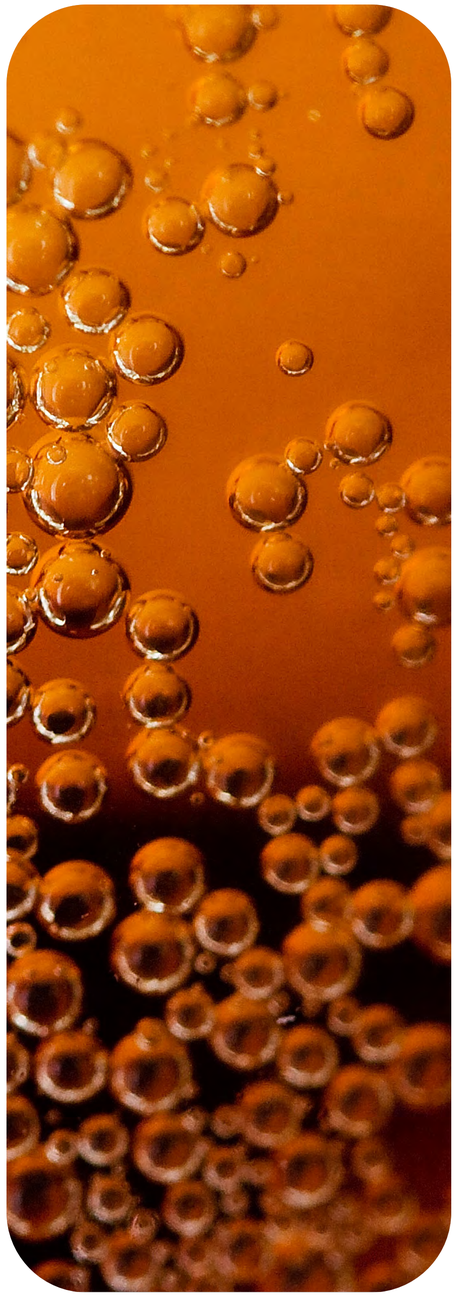
Composition

Members combine a diversity of skills and backgrounds reflecting the current issues and regulatory landscape, including:

- Expertise in animal health or animal welfare and ethics,
- Expertise in (eco)toxicology testing, including NAMs,
- Expertise in current challenges, i.e. chemical pollution, waste, sustainability, circularity and biodiversity.

Terms of reference of the panel

- The panel provides independent scrutiny of and support for Shell's activities in animal testing and welfare,
- The panel offers observations and advice on Shell's performance concerning the 3Rs,
- The panel offers expertise in the relevant research on animal welfare topics in Shell,
- Shell invites individual panel members to serve for three years, with the possibility of being invited to serve for a second term of three more years,
- The panel recommends candidates who could be invited by Shell to join the panel, either as replacements for current members when their term has expired or to supplement the current membership,
- The panel takes part in biannual meetings with key Shell personnel involved in animal testing procedures. It does not verify the accuracy of the data underlying the report,
- In recognition of their time and expertise, panel members receive an honorarium and reimbursement for travel and accommodation expenses.



Panel membership

Jim Bridges (Emeritus Professor of Toxicology and Environmental Health at the University of Surrey, UK)

Jim Bridges held previous positions in the University of Surrey, including Dean of Science and the founding head of two large health research and teaching institutes. He has published around 400 papers and reviewed and trained 98 PhD students. He is a founder of both the British Toxicology Society and EUROTOX. His work for the EU included serving as chair of two scientific committees – Emerging and Newly Identified Health Risks; and Toxicity, Ecotoxicity and the Environment – and being a member of several working groups on future risk assessment methodology that have addressed alternatives to animal testing.

Sarah Wolfensohn OBE FRCVS (Emerita Professor of Animal Welfare at the University of Surrey, UK)

Sarah Wolfensohn is a veterinary surgeon and a European specialist in animal welfare, ethics and law. While in general practice, she became Named Veterinary Surgeon for a number of small pharmaceutical and biotech companies before being appointed Head of Veterinary Services at the University of Oxford. She was Professor of Animal Welfare at the University of Surrey's veterinary school until July 2024, and runs an independent consultancy on animal health and welfare. She has published textbooks and numerous papers in the area of animal science and welfare and is a member of the UK government's Animal Welfare Committee. She was previously a member of the UK Animals in Science Committee and the Animal Procedures Committee and was closely involved in the UK government's development of its Animal Health and Welfare Strategy. She has served on several international committees and working groups that seek to refine animal use and improve welfare.

Jay Ingram (Director of Chemicals, Humane Society International)

In his role as Director of Chemicals at Humane Society International, Jay Ingram engages with multiple stakeholders to drive science-led policy and regulatory changes that aim to integrate and leverage Non-Animal Methods and phase out cruel animal testing practices in current regulatory frameworks. He has over 15 years' experience working in the private sector at the intersection of regulations and toxicology, conducting human health safety assessments, and leading teams to ensure safe and compliant products reach the market. He has sat on numerous industry working groups. Jay has now taken his experience to the NGO sector and is promoting the change necessary to realise regulatory frameworks that leverage toxicity testing based on human-relevant biological modes and no longer rely on animal testing.

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Cautionary note

The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this report "Shell", "Shell Group" and "Group" are sometimes used for convenience where references are made to Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. "Subsidiaries", "Shell subsidiaries" and "Shell companies" as used in this report refer to entities over which Shell plc either directly or indirectly has control. The term "joint venture", "joint operations", "joint arrangements", and "associates" may also be used to refer to a commercial arrangement in which Shell has a direct or indirect ownership interest with one or more parties. The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

Forward-looking statements

This report contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim"; "ambition"; "anticipate"; "believe"; "commit"; "commitment"; "could"; "estimate"; "expect"; "goals"; "intend"; "may"; "milestones"; "objectives"; "outlook"; "plan"; "probably"; "project"; "risks"; "schedule"; "seek"; "should"; "target"; "will"; "would" and similar terms and phrases. There are a number of factors that could affect the future operations of Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this report, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, judicial, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; (m) risks associated with the impact of pandemics, such as the COVID-19 (coronavirus) outbreak, regional conflicts, such as the Russia-Ukraine war, and a significant cybersecurity breach; and (n) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. All forward-looking statements contained in this report are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Shell plc's Form 20-F for the year ended December 31, 2023 (available at www.shell.com/investors/news-and-filings/sec-filings and www.sec.gov). These risk factors also expressly qualify all forward-looking statements contained in this report and should be considered by the reader. Each forward-looking statement speaks only as of the date of this report, June 30, 2024. Neither Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this report.

Shell's Net Carbon Intensity

Also, in this report we may refer to Shell's "Net Carbon Intensity" (NCI), which includes Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell's NCI also includes the emissions associated with the production and use of energy products produced by others which Shell purchases for resale. Shell only controls its own emissions. The use of the terms Shell's "Net Carbon Intensity" or NCI are for convenience only and not intended to suggest these emissions are those of Shell plc or its subsidiaries. Shell's net-zero emissions target Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and NCI targets over the next ten years. However, Shell's operating plans cannot reflect our 2050 net-zero emissions target, as this target is currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans to reflect this movement. However, if society is not net zero in 2050, as of today, there would be significant risk that Shell may not meet this target.

Forward-looking non-GAAP measures

This report may contain certain forward-looking non-GAAP measures such as cash capital expenditure and divestments. We are unable to provide a reconciliation of these forward-looking non-GAAP measures to the most comparable GAAP financial measures because certain information needed to reconcile those non-GAAP measures to the most comparable GAAP financial measures is dependent on future events some of which are outside the control of Shell, such as oil and gas prices, interest rates and exchange rates. Moreover, estimating such GAAP measures with the required precision necessary to provide a meaningful reconciliation is extremely difficult and could not be accomplished without unreasonable effort. Non-GAAP measures in respect of future periods which cannot be reconciled to the most comparable GAAP financial measure are calculated in a manner which is consistent with the accounting policies applied in Shell plc's consolidated financial statements.

The contents of websites referred to in this report do not form part of this report. We may have used certain terms, such as resources, in this report that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

Additional information

As used in this Report, "Accountable" is intended to mean: required or expected to justify actions or decisions. The Accountable person does not necessarily implement the action or decision (implementation is usually carried out by the person who is Responsible) but must organise the implementation and verify that the action has been carried out as required. This includes obtaining requisite assurance from Shell companies that the framework is operating effectively. "Responsible" is intended to mean: required or expected to implement actions or decisions. Each Shell company and Shell-operated venture is responsible for its operational performance and compliance with the Shell General Business Principles, Code of Conduct, Statement on Risk Management and Risk Manual, and Standards and Manuals. This includes responsibility for the operationalisation and implementation of Shell Group strategies and policies. CO_2 compensation does not imply that there is no environmental impact from the production and use of the product as associated emissions remain in the atmosphere. CO_2 compensation is not a substitute for switching to lower-emission energy solutions or reducing the use of fossil fuels. Shell businesses focus first on emissions that can be avoided or reduced and only then, compensate the remaining emissions. "Carbon neutral" or "CO_2 compensated" indicates that Shell will engage in a transaction where an amount of CO_2 equivalent to the value of the remaining CO_2e emissions associated with the raw material extraction, transport, production, distribution and usage/end-of-life (if Lubricants or other non-energy product) of the product are compensated through the purchase and retirement of carbon credits generated from CO_2 compensation projects. Although these carbon credits have been generated in accordance with international carbon standards, the compensation may not be exact. CO_2e (CO_2 equivalent) refers to CO_2, CH_4, N_2O.