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Aarhus University

Aarhus Genome Data Center

Independent service auditor's ISAE 3000 assurfance report on IT general controls during the period from 1 September 2023 to 31 August 2024 in relation to Aarhus Genome Data Center's GenomeDK HPC services

October 2024

Contents

1 Management's statement

The accompanying description has been prepared for customers who have used Aarhus Genome Data Center's GenomeDK HPC services (GenomeDK) and who have a sufficient understanding to consider the description, along with other information, including information about controls operated by the customers' themselves, when assessing the risks of material misstatements.

GenomeDK uses Incuba as subservice supplier of housing for backup, and AU IT and AU BYG (NAT) as subservice suppliers of hosting services. This report uses the carve-out method and does not comprise control objectives and related controls that Incuba performs for GenomeDK.

Some of the control objectives stated in our description in section 3 can only be achieved if the complementary controls at the customers are suitably designed and operating effectively with our controls. This report does not comprise the suitability of the design and operating effectiveness of these complementary controls.

GenomeDK confirms that:

a) The accompanying description in section 3 fairly presents Aarhus Genome Data Center's operation of GenomeDK HPC services that have processed the customers' transactions throughout the period from 1 September 2023 to 31 August 2024. The criteria used in making this statement were that the accompanying description:

   (i) Presents how IT general controls in relation to Aarhus Genome Data Center's operation of GenomeDK HPC services were designed and implemented, including:

   - The types of services provided
   - The procedures, within both information technology and manual systems, by which the IT general controls were managed
   - Relevant control objectives and controls designed to achieve those objectives
   - Controls that we assumed, in the design of Aarhus Genome Data Center's operation of GenomeDK HPC services, would be implemented by user entities and which, if necessary to achieve the control objectives stated in the accompanying description, are identified in the description
   - How the system dealt with significant events and conditions other than transactions
   - Other aspects of our control environment, risk assessment process, information system (including the related business processes) and communication, control activities and monitoring controls that were relevant to the IT general controls

   (ii) Includes relevant details of changes to IT general controls in relation to Aarhus Genome Data Center's operation of GenomeDK HPC services during the period from 1 September 2023 to 31 August 2024

   (iii) Does not omit or distort information relevant to the scope of the IT general controls in relation to Aarhus Genome Data Center's operation of GenomeDK HPC services being described, while acknowledging that the description is prepared to meet the common needs of a broad range of customers and may not, therefore, include every aspect of the IT general controls in relation to Aarhus Genome Data Center's operation of GenomeDK HPC services that each individual customer may consider important in its own particular environment.

b) The controls related to the control objectives stated in the accompanying description were suitably designed and operated effectively throughout the period from 1 September 2023 to 31 August 2024. The criteria used in making this statement were that:

(i) The risks that threatened achievement of the control objectives stated in the description were identified;

(ii) The identified controls would, if operated as described, provide reasonable assurance that those risks did not prevent the stated control objectives from being achieved; and

(iii) The controls were consistently applied as designed, including that manual controls were applied by persons who have the appropriate competence and authority, throughout the period from 1 September 2023 to 31 August 2024.

Aarhus, 31 October 2024
Aarhus Genome Data Center

Anders Børglum
Professor

2 Independent service auditor's assurance report on the description, design and operating effectiveness of controls

Independent service auditor's ISAE 3000 assurance report on IT general controls during the period from 1 September 2023 to 31 August 2024 in relation to Aarhus Genome Data Center's GenomeDK HPC services to customers

To: GenomeDK and customers who have used Aarhus Genome Data Center's GenomeDK HPC services

Scope

We have been engaged to provide assurance about GenomeDK's description in section 3 of its IT general controls in relation to Aarhus Genome Data Center's GenomeDK HPC services which have processed customers' transactions throughout the period from 1 September 2023 to 31 August 2024 and about the design and operating effectiveness of controls related to the control objectives stated in the description.

GenomeDK uses Incuba as subservice supplier of housing for backup, and AU IT and AU BYG (NAT) as subservice suppliers of hosting services. This report uses the carve-out method and does not comprise control objectives and related controls that Incuba performs for GenomeDK.

Some of the control objectives stated in GenomeDK's description in section 3 can only be achieved if the complementary controls at the customers are suitably designed and operating effectively with GenomeDK's controls. This report does not comprise the suitability of the design and operating effectiveness of these complementary controls.

We express reasonable assurance in our conclusion.

GenomeDK's responsibilities

GenomeDK is responsible for: preparing the description and accompanying statement in section 1, including the completeness, accuracy and method of presentation of the description and statement; providing the services covered by the description; stating the control objectives and designing, implementing and effectively operating controls to achieve the stated control objectives.

Service auditor's independence and quality control

We have complied with the independence and other ethical requirements in the International Ethics Standards Board for Accountants' International Code of Ethics for Professional Accountants (IESBA Code), which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional conduct, as well as ethical requirements applicable in Denmark.

Our firm applies International Standard on Quality Management 1, ISQM 1, which requires the firm to design, implement and operate a system of quality management, including policies or procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

Service auditor's responsibilities

Our responsibility is to express an opinion on GenomeDK's description and on the design and operating effectiveness of controls related to the control objectives stated in that description, based on our procedures.

We conducted our engagement in accordance with ISAE 3000, "Assurance engagements other than audits or reviews of historical financial information", and additional requirements applicable in Denmark to obtain reasonable assurance about whether, in all material respects, the description is fairly presented, and the controls are suitably designed and operating effectively.

An assurance engagement to report on the description, design and operating effectiveness of controls at a service organisation involves performing procedures to obtain evidence about the disclosures in the service organisation's description of its service and the design and operating effectiveness of controls. The procedures selected depend on the service auditor's judgement, including the assessment of risks that the description is not fairly presented, and that controls are not suitably designed or operating effectively. Our procedures included testing the operating effectiveness of those controls that we consider necessary to provide reasonable assurance that the control objectives stated in the description were achieved. An assurance engagement of this type also includes evaluating the overall presentation of the description, the suitability of the objectives stated therein and the suitability of the criteria specified and described by GenomeDK in the Management's statement section.

We believe that the evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Limitations of controls at a service organisation

GenomeDK's description is prepared to meet the common needs of a broad range of customers and may not, therefore, include every aspect of the GenomeDK HPC services that the individual customer may consider important in its particular circumstances. Also, because of their nature, controls at a service organisation may not prevent or detect all errors or omissions in processing or reporting transactions. Furthermore, the projection of any evaluation of effectiveness to future periods is subject to the risk that controls at a service organisation may become inadequate or fail.

Opinion

Our opinion has been formed on the basis of the matters outlined in this auditor's report. The criteria we used in forming our opinion are those described in the Management's statement section. In our opinion, in all material respects:

a) The description fairly presents how IT general controls in relation to Aarhus Genome Data Center's GenomeDK HPC services were designed and implemented throughout the period from 1 September 2023 to 31 August 2024;

b) The controls related to the control objectives stated in the description were suitably designed throughout the period from 1 September 2023 to 31 August 2024; and

c) The controls tested, which were those necessary to provide reasonable assurance that the control objectives stated in the description were achieved, operated effectively throughout the period from 1 September 2023 to 31 August 2024.

Description of test of controls

The specific controls tested and the nature, timing and results of these tests are listed in section 4.

Intended users and purpose

This report and the description of tests of controls in section 4 are intended only for customers who have used GenomeDK HPC services and who have a sufficient understanding to consider it along with other information, including information about controls operated by the customers themselves, in assessing the risks of material misstatement.

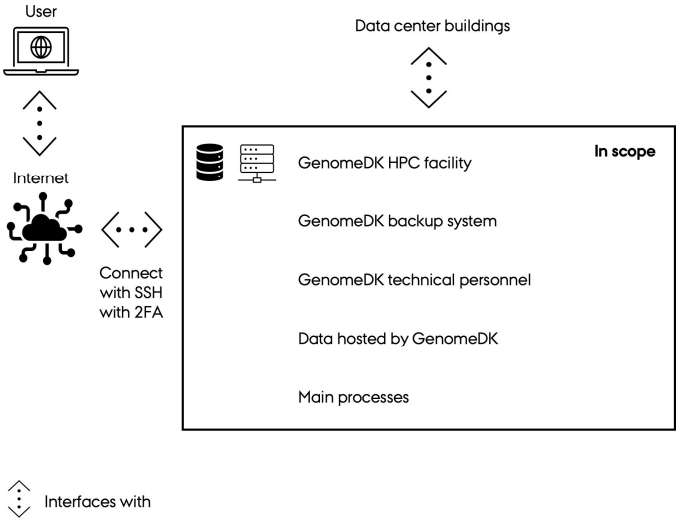
Aarhus, 31 October 2024
PricewaterhouseCoopers
Statsautoriseret Revisionspartnerselskab
CVR no. 33 77 12 31

Jesper Parsberg Madsen
State-Authorised Public Accountant
mne26801

3 System description

3.1 Introduction

GenomeDK is a high-performance computing facility designed to store and compute on large, sensitive data sets. The facility is ISO 27001-certified, and is compliant with the General Data Protection Regulation (GDPR) and the Danish Data Protection Act. The facility is owned by Aarhus University (AU) and managed under Aarhus Genome Data Center (AGC). GenomeDK hosts large amounts (petabytes) of sensitive data for researchers, SMEs and Aarhus University Hospital (AUH).



3.1.1 Scope

The scope of this ISMS is limited to GenomeDK as a hosting service providing computational power and storage capacity. As such, the scope only contains the hardware, software and the processes that are involved in providing this capacity and securing user data.

GenomeDK is completely isolated from Aarhus University. The reason we can consider this isolated is we only have two controlled interfaces to the surroundings:

- Data centre room provided by Aarhus University with cooling, emergency power, fire protection, etc.
- Internet access provided by Aarhus University, use of this connection for GenomeDK access is encrypted by SSH.

The separation between Aarhus University and GenomeDK allows GenomeDK to provide tightened security for the data hosted on GenomeDK and makes it convenient to support access to GenomeDK for non-Aarhus University collaborators and SMEs.

3.1.1.1 Processes included in the scope

The scope includes the following processes:

- User request process description:
  - Input: a user request
  - Output: approved user can access GenomeDK

- Main activities:
  - Zone owner approves or rejects the user request.
  - If approved, technical personnel use an automated procedure to create the user on GenomeDK.
  - User is informed by the automated procedure.

- Project folder creation:
  - Input: a user requests a project folder
  - Output: user can access the approved project folder
  - Main activities:
    - User requests a project folder on GenomeDK.
    - Project folder request is approved or rejected by technical personnel. If accepted, the technical personnel use an automated procedure to create the project folder.
    - User is informed by the automated procedure.

- User deactivation:
  - Input: zone owner requests deactivation, user inactivity, user violates terms of service.
  - Output: the user is deactivated and can no longer access GenomeDK.
  - Main activities:
    - Technical personnel use an automated procedure to deactivate the user.

- Technical maintenance:
  - Input: ad-hoc maintenance, planned maintenance, maintenance triggered by incidents, alarms, or other events.
  - Output: stable and secure compute and storage capacity.
  - Main activities:
    - Keeping system software up-to-date planned and carried out by the technical personnel.
    - Planning purchase and installation of new assets, and retirement of old assets.
    - Ensuring that the necessary software services and tools are present and working.
    - Information security activities according to ISO 27001 and this ISMS.

The processes are supported as necessary by software developed by the technical personnel for GenomeDK.

3.1.2 *The provided services*

GenomeDK offers access to a Linux-based high-performance computing facility on which users can submit jobs to a range of "compute" machines to perform computations on those machines in a highly parallel fashion. The compute machines have access to a high-capacity, parallel file system. Users can obtain "project folders" on this file system to securely store and manage access to their data. A project folder is the only way to share data between users on GenomeDK, and the project owner is responsible for the resources by the project.

For users with additional requirements, GenomeDK provides an additional layer of control through "closed zones". Closed zones are designed to prevent accidental or unintended disclosure of sensitive data located in the closed zone by restricting the user to a virtual desktop without copy-paste, restricting Internet access, and only allowing data to leave the zone/GenomeDK with approval from the zone owner.

3.1.3 *Information security objectives*

GenomeDK aims to maintain confidentiality, integrity and availability (CIA) by:

- defining clear business objectives and documenting these (see "Business objectives")

- deriving information security objectives from our business objectives, to ensure that our information security objectives are aligned with our business objectives
- establishing an information security risk assessment process that defines risk acceptance criteria and criteria for performing risk assessments
- documenting our risk assessment process through our risk analysis and risk treatment plan
- the adherence of the plan-do-check-act process which is documented through monthly meeting minutes and checklists.

Significant incidents that influence our business or information security objectives are discussed at monthly steering committee meetings. These processes ensure that GenomeDK continuously improves with regard to the information security objectives.

3.1.3.1 Documentation organisation

In accordance with the ISO 27001 standards section 7.5 on "Documented organization", the documentation in this ISMS is:

- Reviewed yearly for suitability and adequacy by the technical steering committee
- Made available through the standard PDF format.

All documents are named uniquely and are available to GenomeDK employees and management. The ISMS is stored in automatic version control and is backed up.

3.2 Stakeholder analysis

Stakeholder	Description	Formal information security requirements
Aarhus University (AU)	AU owns GenomeDK and provides it as a service to its own researchers and students, as well as their (international) collaborators, and to other Danish universities through the DeiC National HPC collaboration (see below). GenomeDK is a significant asset to AU because it provides significant computational resources used for a wide range or research, but also because GenomeDK is the only infrastructure at AU which can store large amounts of sensitive data and allow computations on such data.	AU has no formal requirements for GenomeDK.
Aarhus University Hospital (AUH)/ Region Midtjylland	AUH is a major contributor to GenomeDK's yearly budget. AUH uses GenomeDK for both research and clinical applications, with strict requirements on reliability and security.	Requirements specified in the data protection agreement between GenomeDK and Region Midtjylland and the associated appendices.
Danish e-Infrastructure Consortium (DeiC)	DeiC contributes significantly to GenomeDK's yearly budget and relies on GenomeDK for providing secure HPC services to researchers at other Danish universities.	Requirements specified in the agreement between GenomeDK and DeiC. ISO 27001-compliance is required.
Others	Other users include the researchers, students, and SMEs that use GenomeDK for data storage and processing.	Users can expect GenomeDK to provide the services described above under the terms described in GenomeDK's Terms of Service.

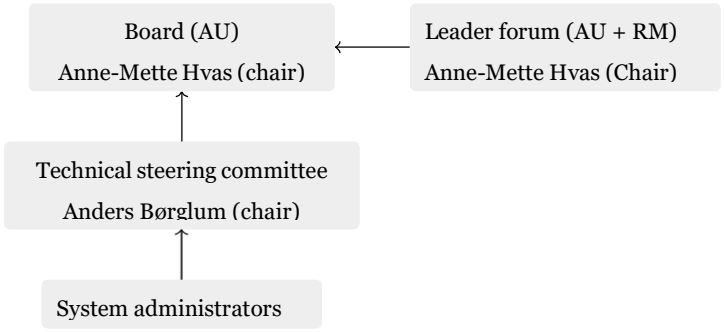
3.3 Organisation

Aarhus Genome Data Center (AGC) is centre at Aarhus University. The centre is formally anchored under Institute of Biomedicine, Faculty of Health.

The centre is a collaboration between Aarhus University (AU) and the Central Denmark Region (RM), however, the GenomeDK is owned and run solely by AU.

The centre is managed by the board, which consists of representatives from AU. The leader forum consists of representatives from both AU and RM and provides input to the board and facilitates synergies between the two parties.

The technical steering committee is responsible for day-to-day management of GenomeDK and consists of representatives from the three parties and the technical personnel (system administrators) at GenomeDK.



Anders Børglum is head of AGC and is responsible for day-to-day management of GenomeDK, as well as responsible for overall information security at GenomeDK.

3.4 Plan-do-check-act

GenomeDK follows the plan-do-check-act process and has incorporated it directly into the monthly steering committee meetings.

In the meeting minute templates used by the GenomeDK steering committee, it can be seen how GenomeDK has planned, implemented and controlled the processes needed to meet the ISMS requirements and how GenomeDK has implemented risk analysis and risk treatment actions in the risk assessment and fulfils the stated security objectives in accordance with the ISO 27001 standard.

Additionally, yearly information security objectives are planned by the technical steering committee and managed through a plan-do-check-act template.

3.5 Risk management and policies

GenomeDK uses a scenario-based risk assessment approach closely aligned to risks and threats defined in ISO 27005. Policies have been defined for all relevant items in Annex A of the ISO 27001 specification to ensure that risks are controlled and minimised. The risk assessment is continuously updated and discussed in the technical steering committee.

The following matrix shows which preventative and remedial controls have been implemented by GenomeDK:

	Preventative controls	**Remedial controls**
Organisational controls	Policies and procedures; Awareness; Change management; Technical best practices; Compliance controls	Incident management; Disaster management
Physical and technical controls	Firewalls; Health checks; Isolated test environments; UPS; Emergency power generator; Dynamic network segregation; Fire detection system	Logging; Backup/restore; Fire suppression system

3.5.1 Information security policy and organisation of information security

A formal policy has been defined to ensure that information security responsibilities and roles are clearly defined.

The board has defined and described information security responsibilities in a formal information security policy, as well as information security objectives derived from the organisation's long- term business objectives (see section 3.1.3).

GenomeDK is audited with regards to ISO 27001 and GDPR by an external, independent party on an annual basis.

3.5.2 Human resource security

GenomeDK has defined policies for employment/on-boarding of new personnel as well as change of roles/responsibilities and termination of employment.

All employees are obliged to confidentiality and are informed about the criticality of the data that is hosted on GenomeDK. Employees must also read and understand the GenomeDK information security policy.

Employees must only have privileged access to systems during their employment. All privileged access must be revoked if no longer necessary due to a change of employment or termination.

3.5.3 Asset management

GenomeDK has defined policies for ownership and handling of assets and disposal of media.

An inventory is kept for all significant hardware assets. Media containing potentially sensitive data must be destroyed when decommissioned.

3.5.4 Access control

All potential users must submit a formal request to access GenomeDK. The request must be approved by a zone administrator before an account is created on the system.

GenomeDK follows industry best practices for password management and uses two-factor authentication for all connections to the facility.

All users connect to GenomeDK through a secure, encrypted channel (SSH) with two-factor authentication.

Access to data is controlled through *projects*. A project has a project owner. Only the project owner can grant and revoke access to the project and the data contained within. Without access to a project, a user has access to a very limited amount of compute and storage resources.

GenomeDK performs periodic, automated reviews of users to revoke access for users that are no longer active.

System administrators are the *only* privileged users on GenomeDK.

3.5.5 Cryptography

GenomeDK has defined policies for cryptographic controls. All traffic to/from GenomeDK must use an encrypted connection, and only privileged users must be able to access confidential authentication information (passwords, host keys, certificates, etc.).

3.5.6 Physical and environmental security

GenomeDK has defined policies for physical and environmental security based on the criticality of the infrastructure/equipment and the sensitivity of the data stored in the perimeter.

GenomeDK is physically located in a modern, secure server room with 24/7 surveillance at the Aarhus University campus. Data centres are protected from environmental threats and secured with (at least) double doors and door card locks.

Data centres hosting unencrypted data (which may be sensitive) must apply additional controls such as video surveillance and alarm systems.

Work in secure areas must be work-related, and visitors must be authorised and escorted by authorised personnel.

3.5.7 Operations security

As part of the ISMS implemented by GenomeDK, policies and procedures have been defined to ensure stable and secure operations. This is done through (amongst others) change management and procedures for handling incidents. GenomeDK has also implemented weekend duty for system administrators to ensure any critical problems can be handled over the weekend.

Any changes that may affect information security at GenomeDK are discussed at monthly steering committee meetings and may be escalated to the board. Technical changes are carried out by the system administration team. When necessary, peer review is used to ensure that a change will not affect availability, integrity or confidentiality of the system.

All open/read file operations on GenomeDK are logged and stored for at least 6 months. This provides traceability in case of a loss of confidentiality incident.

In case data is lost, GenomeDK provides access to backup. However, only data marked for backup by users is backed up.

3.5.8 Communications security

Policies have been defined for communications internally on GenomeDK as well as externally. GenomeDK implements both physical and virtual network segregation. The management network is physically separated from production networks. Network segregation on production networks uses firewalls to ensure that only machines in the same zone can communicate.

Transfers to/from external entities are performed by the user over a secure, encrypted connection. In closed zones, the user must request approval from the zone administrator to export files, and the exported file is logged for a year.

3.5.9 Supplier relationships

GenomeDK has defined policies for supplier relationships and is continuously working to formalise relationships with providers to ensure a clear division of responsibilities and that suppliers fulfil the information security requirements required by GenomeDK. GenomeDK management assesses changes to suppliers' information security as part of internal risk assessment reviews.

3.5.10 Information security incident management and business continuity

Policies and procedures are defined to handle information security incidents at GenomeDK efficiently and to minimise service interruptions for the users.

GenomeDK has defined clear responsibilities and actionable items/checklists when dealing with incidents. An incident severity classification has been established, and actions associated with each severity level have been defined.

The incident management policies and procedures also apply to business continuity.

3.5.11 Compliance

Policies and procedures are reviewed and, if necessary, revised on a yearly basis. Risks and threats are continuously reviewed by the technical steering committee and – if necessary – the board, on a yearly basis.

A shared document management system is maintained to host all policies and procedures, as well as a contract/agreement register, to facilitate easy access for the technical steering committee.

The facility is audited with regard to ISO 27001 and GDPR by an external, independent party on an annual basis.

3.6 Competency overview

Daily management:

- must be familiar with the GenomeDK information security management system.

Technical personnel:

- must be familiar with the GenomeDK information security policy and all GenomeDK policies included in the GenomeDK ISMS
- must be familiar with HPC or similar large, distributed IT systems
- must be familiar with large-scale storage systems
- must be familiar with Linux system administration.

The competencies are documented below.

	Anders Børglum	Anders Halager	Dan Søndergaard
GenomeDK information security policy and all GenomeDK policies included in the GenomeDK ISMS	Expert	Familiar	Expert
HPC or similar large, distributed IT systems	N/A	Expert	Expert
Must be familiar with large-scale storage systems	N/A	Expert	Expert
Linux system administration	N/A	Expert	Expert

4 Control objectives, control activity, tests and test results

4.1 Purpose and scope

We conducted our engagement in accordance with ISAE 3000, "Assurance engagements other than audits or reviews of historical financial information", and additional requirements applicable in Denmark.

Our testing of the design, implementation and functionality of the controls has included the control objectives and related control activities selected by Management and listed in section 4.3. Any other control objectives, related controls and controls at customers are not covered by our test actions.

Our operating effectiveness testing included the control activities deemed necessary to obtain reasonable assurance that the stated control objectives were achieved.

4.2 Test actions

The test actions performed when determining the operating effectiveness of controls are described below:

Inspection	Reading of documents and reports containing specifications regarding the execution of the control. This includes reading and consideration of reports and other documentation in order to assess whether specific controls are designed so they may be expected to become effective if implemented. Furthermore, it is assessed whether controls are being monitored and checked sufficiently and at appropriate intervals. We have tested the specific system set-up on the technical platforms, databases and network components in order to verify whether controls are implemented and have functioned during the period from 1 September 2023 to 31 August 2024. Among other things, this includes assessment of patching level, permitted services, segmentation, password complexity, etc. as well as inspection of equipment and locations.
Inquiries	Inquiry of appropriate personnel. Inquiries have included how the controls are performed.
Observation	We have observed the execution of the control.
Reperformance of the control	Repetition of the relevant control. We have repeated the execution of the control to verify whether the control functions as assumed.

4.3 Overview of control objectives, control activity, tests and test results

Control objective A.4: Risk assessment and management

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
4.1.1 Risk assessment and response Management performs an annual risk assessment on the services provided.	We discussed risk assessment and risk response management in general terms with GenomeDK. By inspection, we verified that a Management-approved and updated risk assessment for GenomeDK is in place.	No exceptions noted.

Control objective A.5: Information security policies

Appropriate general guidelines have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
5.1.1 Policies for information security *A set of policies for information security shall be defined, approved by Management, published and communicated to employees and relevant external parties.*	We discussed information security management in general terms with GenomeDK. By inspection, we verified that a Management-approved and updated security policy for GenomeDK is in place and is communicated to the employees.	No exceptions noted.
5.1.2 Review of the policies for information security *The policies for information security shall be reviewed at planned intervals or if significant changes occur to ensure their continuing suitability, adequacy and effectiveness.*	We discussed information security management in general terms with GenomeDK. By inspection, we verified that a Management-approved and updated security policy for GenomeDK is in place and is reviewed annually.	No exceptions noted.

Control objective A.6: Organisation of information security

Appropriate procedures and controls for the organisation of information security have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
6.1.1 Information security roles and responsibilities *All information security responsibilities shall be defined and allocated.*	We discussed information security management in general terms with GenomeDK. By random inspection, we verified that a suitable security organisation exists at GenomeDK.	No exceptions noted.
6.1.2 Segregation of duties *Conflicting duties and areas of responsibility shall be segregated to reduce opportunities for unauthorised or unintentional modification or misuse of the organisation's assets.*	We made inquiries of Management about the procedures/control activities carried out to ensure that access rights to GenomeDK are granted in accordance with adequate business procedures and that the access rights granted are followed up annually.	No exceptions noted.
6.2.1 Mobile device policy *A policy and supporting security measures shall be adopted to manage the risks introduced by using mobile devices.*	We made inquiries of Management about the procedures/control activities carried out, and we verified that an appropriate approval process is applied at GenomeDK. By inspection, we also verified that users are subject to authentication on all access points.	No exceptions noted.
6.2.2 Teleworking *A policy and supporting security measures shall be implemented to protect information accessed, processed or stored at teleworking sites.*	We made inquiries of Management about the procedures/control activities carried out, and we verified that an appropriate approval process is applied at GenomeDK. By inspection, we also verified that users are subject to authentication on all access points.	No exceptions noted.

Control objective A.7: Personnel security

Appropriate procedures and controls for the management of personnel security have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
7.1.1 Screening *Background verification checks on all candidates for employment shall be carried out in accordance with relevant laws, regulations and ethics and shall be proportional to the business requirements, the classification of the information to be accessed and the perceived risks.*	We discussed personnel security management in general terms with GenomeDK. By inspection, we verified that screening of employees is carried out in accordance with relevant laws, regulations and the code of ethics and must be proportional to the business requirements, to the classification of the information to which access is to be granted and to the relevant risks.	No exceptions noted.
7.2.2 Information security awareness, education and training *All employees of the organisation and, where relevant, contractors shall receive appropriate awareness education and training and regular updates in organisational policies and procedures, as relevant for their job function.*	We discussed personnel security management in general terms with GenomeDK. By inspection, we verified that a Management-approved and updated security policy for GenomeDK is in place.	No exceptions noted.
7.3.1 Termination or change of employment responsibilities *Information security responsibilities and duties that remain valid after termination or change of employment shall be defined, communicated to the employee or contractor and enforced.*	We made inquiries of Management about the procedures/control activities carried out to ensure that access rights are revoked in accordance with adequate business processes and that the rights granted are followed up on in accordance with the business processes. By inspection, we verified that the business procedures described for terminated users at GenomeDK are complied with.	No exceptions noted.

Control objective A.8: Asset management

Appropriate procedures and controls for the management of information assets have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
8.1.1 Inventory of assets *Assets associated with information and information processing facilities shall be identified, and an inventory of these assets shall be drawn up and maintained.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
8.1.2 Ownership of assets *Assets maintained in the inventory shall be owned.*	We made inquiries of Management about the procedures/control activities carried out. By inspection, we verified that assets maintained in the inventory are owned.	No exceptions noted.
8.1.4 Return of assets *All employees and external users shall return all of the organisational assets in their possession upon termination of their employment, contract or agreement.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
8.2.1 Classification of information *Information shall be classified in terms of legal requirements, value, criticality and sensitivity to unauthorised disclosure or modification.*	We made inquiries of Management about the procedures/control activities carried out. By inspection, we verified that information is classified in terms of legal requirements, value, criticality and sensitivity to unauthorised disclosure or modification.	No exceptions noted.
8.3.2 Disposal of media *Media shall be disposed of securely when no longer required, using formal procedures.*	We made inquiries of Management about the procedures/control activities carried out. We verified that GenomeDK has implemented formalised procedures for the disposal and destruction of media when no longer needed.	No exceptions noted.

Control objective A.9: Access control

Appropriate procedures and controls for access control have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
9.1.1 Access control policy *An access control policy shall be established, documented and reviewed based on business and information security requirements.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the procedures for user administration and checked that they are adequate.	No exceptions noted.
9.1.2 Access to networks and network services *Users shall only be provided with access to the network and network services that they have been specifically authorised to use.*	We made inquiries of Management about the procedures/control activities carried out, and we verified that an appropriate approval process is applied at GenomeDK. By inspection, we also verified that users are subject to authentication on all access points. We observed that the network is segmented into smaller networks to reduce the risk of unauthorised access.	No exceptions noted.
9.2.1 User registration and de-registration *A formal user registration and de-registration process shall be implemented to enable assignment of access rights.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the procedures for user administration and checked that they are adequate. By inspection, we verified that applicable procedures for users created at GenomeDK are complied with.	No exceptions noted.
9.2.2 User access provisioning *A formal user access provisioning process shall be implemented to assign or revoke access rights for all user types to all systems and services.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the procedures for user administration and checked that they are adequate. By inspection, we verified that the business procedures for users created are complied with.	No exceptions noted.

Control objective A.9: Access control

Appropriate procedures and controls for access control have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
9.2.3 Management of privileged access righ12.ts *The allocation and use of privileged access rights shall be restricted and controlled.*	We made inquiries of Management about the procedures/control activities carried out to ensure that privileged access rights are allocated in accordance with adequate business procedures. By random inspection, we verified that the business procedures for users created are complied with.	No exceptions noted.
9.2.5 Review of user access rights *Asset owners shall review users' access rights at regular intervals.*	We made inquiries of Management about the procedures/control activities carried out to ensure that access rights are granted in accordance with adequate business procedures and that the access rights granted are followed up annually.	No exceptions noted.
9.2.6 Removal or adjustment of access rights *The access rights of all employees and external users to information and information processing facilities shall be removed upon termination of their employment, contract or agreement, or adjusted upon change.*	We made inquiries of Management about the procedures/control activities carried out to ensure that access rights are revoked in accordance with adequate business processes and that the rights granted are followed up on in accordance with the business processes. By inspection, we verified that business procedures for terminated users are complied with.	No exceptions noted.
9.4.1 Information access restriction *Access to information and application system functions shall be restricted in accordance with the access control policy.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the procedures for user administration and checked that they are adequate.	No exceptions noted.
9.4.2 Secure log-on procedures *Where required by the access control policy, access to systems and applications shall be controlled by a secure log-on procedure.*	We made inquiries of Management about procedures/control activities carried out in connection with password controls, and we verified that users are subject to appropriate authentication on all access points.	No exceptions noted.

Control objective A.10: Cryptography – Appropriate general guidelines have been established

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
10.1.1 Policy on the use of cryptographic controls *A policy on the use of cryptographic controls for protection of information shall be developed and implemented.*	We discussed cryptography management in general terms with GenomeDK.	No exceptions noted.

Control objective A.11: Physical and environmental security
Appropriate procedures and controls for physical security have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
11.1.1 Physical security perimeter *Security perimeters shall be defined and used to protect areas that contain either sensitive or critical information and information processing facilities.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
11.1.2 Physical entry controls *Secure areas shall be protected by appropriate entry controls to ensure that only authorised personnel are allowed access.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
11.1.3 Securing offices, rooms and facilities *Physical security for offices, rooms and facilities shall be designed and applied.*	We made inquiries of Management about the procedures/control activities carried out and checked that access to GenomeDK's offices and rooms is limited to relevant employees.	No exceptions noted.
11.1.4 Protecting against external and environmental threats *Physical protection against natural disasters, malicious attack or accidents shall be designed and applied.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
11.2.2 Supporting utilities (security of supply) *Equipment shall be protected from power failures and other disruptions caused by failures in supporting utilities.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
11.2.3 Cabling security *Power and telecommunications cabling carrying data or supporting information services shall be protected from interception, interference or damage.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.
11.2.4 Equipment maintenance *Equipment shall be correctly maintained to ensure its continued availability and integrity.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.

A.12 Control objective: Operational security

Appropriate procedures for operations management and monitoring have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
12.1.1 Documented operating procedures *Operating procedures shall be documented and made available to all users who need them.*	We made inquiries of Management about the procedures/control activities carried out. We checked that adequate procedures for operating GenomeDK are in place.	No exceptions noted.
12.1.2 Change management *Changes to the organisation, business processes, information processing facilities and systems that affect information security shall be controlled.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the adequacy of the CM procedures and verified that an appropriate change management system has been set up.	No exceptions noted.
12.1.4 Separation of development, testing and operational environments *Development, testing and operational environments shall be separated to reduce the risks of unauthorised access or changes to the operational environment.*	We made inquiries of Management about the procedures/control activities carried out and by inspection verified that environments are adequately separated.	No exceptions noted.
12.2.1 Controls against malware *Detection, prevention and recovery controls to protect against malware shall be implemented, combined with appropriate user awareness.*	We made inquiries of Management about the procedures/control activities carried out and by inspection verified that appropriate controls to protect against malware have been implemented.	No exceptions noted.
12.3.1 Information backup *Backup copies of information, software and system images shall be taken and tested regularly in accordance with an agreed backup policy.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the backup procedures and verified that they are adequate.	No exceptions noted.
12.4.1 Event logging *Event logs recording user activities, exceptions, faults and information security events shall be produced, kept and regularly reviewed.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the event logging procedures and verified that they are adequate.	No exceptions noted.

A.12 Control objective: Operational security

Appropriate procedures for operations management and monitoring have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
12.4.2 Protection of log information *Logging facilities and log information shall be protected against tampering and unauthorised access.*	We made inquiries of Management about the procedures/control activities carried out and reviewed the system set-up on servers. Furthermore, we verified that logging parameters are set up to ensure that actions performed by users with extended access rights are logged. By random inspection, we checked that logs from critical systems are protected against unauthorised access and tampering.	No exceptions noted.
12.4.3 Administrator and operator logs *System administrator and system operator activities shall be logged and the logs protected and regularly reviewed.*	We made inquiries of Management about the procedures/control activities carried out and reviewed the system set-up on servers. Furthermore, we verified that logging parameters are set up to ensure that actions performed by users with extended access rights are logged. By random inspection, we also verified that adequate follow-up on logs from critical systems is performed.	No exceptions noted.
12.5.1 Installation of software on operational systems *Procedures shall be implemented to control the installation of software on operational systems.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the adequacy of the CM procedures and verified that an appropriate change management system has been set up.	No exceptions noted.
12.6.1 Management of technical vulnerabilities *Information about technical vulnerabilities of information systems being used shall be obtained in a timely fashion, the organisation's exposure to such vulnerabilities evaluated and appropriate measures taken to address the associated risk.*	We made inquiries of Management about the procedures/control activities carried out, reviewed the adequacy of the CM procedures and verified that an appropriate change management system has been set up.	No exceptions noted.

Control objective A.13: Communications security

Appropriate procedures have been established for management and monitoring of networks and data communications.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
13.1.1 Network controls *Networks shall be managed and controlled to protect information in systems and applications.*	We made inquiries of Management about the procedures/control activities carried out. We observed that the network is segmented into smaller networks to reduce the risk of un-authorised access.	No exceptions noted.
13.1.2 Security of network services *Security mechanisms, service levels and management requirements of all network services shall be identified and included in network services agreements, whether these services are provided in-house or outsourced.*	We made inquiries of Management about the procedures/control activities carried out. We observed that the network is segmented into smaller networks to reduce the risk of un-authorised access.	No exceptions noted.
13.1.3 Segregation in networks *Groups of information services, users and information systems shall be segregated on networks.*	We made inquiries of Management about the procedures/control activities carried out. We observed that the network is segmented into smaller networks to reduce the risk of un-authorised access.	No exceptions noted.
13.2.1 Information transfer policies and procedures *Formal transfer policies, procedures and controls shall be in place to protect the transfer of information through the use of all types of communication facilities.*	We made inquiries of Management about the procedures/control activities carried out.	No exceptions noted.

Control objective A.15: Supplier relationships

Appropriate procedures have been established to protect TDC's and TDC customers' assets to which suppliers have access.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
15.1.1 Information security policy for supplier relationships *Information security requirements for mitigating the risks associated with supplier's access to the organisation's assets shall be agreed with the supplier and documented.*	We discussed information security management in general terms with GenomeDK. By inspection, we verified that a Management-approved and updated security policy for GenomeDK is in place and that contracts with suppliers contain IT security requirements.	No exceptions noted.
15.2.1 Monitoring and review of supplier services *Organisations shall regularly monitor, review and audit supplier service delivery.*	We discussed information security management in general terms with GenomeDK. By random inspection, we verified that suitable procedures for regular monitoring and review of supplier services are in place and that these procedures are complied with.	No exceptions noted.

Control objective A.16: Information security incident management

Appropriate procedures and controls for the management of security incidents have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
16.1.1 Responsibilities and procedures *Management responsibilities and procedures shall be established to ensure a quick, effective and orderly response to information security incidents.*	We discussed information security management in general terms with GenomeDK. By random inspection, we verified that a suitable security organisation exists at GenomeDK that ensures a satisfactory handling of information security breaches.	No exceptions noted.
16.1.2 Reporting information security events *Information security events shall be reported through appropriate management channels as quickly as possible.*	We discussed information security management, including information security events, in general terms with GenomeDK. We checked that adequate procedures are in place for recording and reporting on information security events related to GenomeDK.	No exceptions noted.
16.1.3 Reporting information security weaknesses *Employees and contractors using the organisation's information systems and services shall be required to note and report any observed or suspected information security weaknesses in systems or services.*	We discussed information security management, including information security events, in general terms with GenomeDK. We checked that adequate procedures are in place for recording and reporting on information security events related to GenomeDK.	No exceptions noted.
16.1.4 Assessment of and decision on information security events *Information security events shall be assessed, and it shall be decided if they are to be classified as information security incidents.*	We discussed information security management, including information security events, in general terms with GenomeDK. We checked that adequate procedures are in place for recording and reporting on information security events related to GenomeDK.	No exceptions noted.
16.1.5 Response to information security incidents *Information security incidents shall be responded to in accordance with the documented procedures.*	We discussed information security management, including information security events, in general terms with GenomeDK. We checked that adequate procedures are in place for recording and reporting on information security events related to GenomeDK.	No exceptions noted.

A.17 Control objective: Information security aspects of business continuity management

Appropriate procedures and controls for contingency management have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
17.1.1 Planning information security continuity *The organisation shall determine its requirements for information security and the continuity of information security management in adverse situations, e.g. during a crisis or disaster.*	We made inquiries of Management about the procedures/control activities carried out in relation to information security continuity. We verified that procedures and plans for information security continuity in relation to GenomeDK have been implemented.	No exceptions noted.
17.1.2 Implementing information security continuity *The organisation shall establish, document, implement and maintain processes, procedures and controls to ensure the required level of continuity for information security during an adverse situation.*	We made inquiries of Management about the procedures/control activities carried out in relation to information security continuity. We verified that procedures and plans for information security continuity in relation to GenomeDK have been implemented.	No exceptions noted.
A.17.1.3 Verify, review and evaluate information security continuity *The organisation shall verify the established and implemented information security continuity controls at regular intervals in order to ensure that they are valid and effective during adverse situations.*	We made inquiries of Management about the procedures/control activities carried out in relation to information security continuity. We verified that procedures and plans for information security continuity in relation to GenomeDK have been implemented.	No exceptions noted.

Control objective A.18: Compliance

Appropriate procedures and controls for compliance with regulatory and contractual requirements have been established.

GenomeDK's control activity	Tests performed by PwC	Result of PwC's tests
18.1.1 Identification of applicable legislation and contractual requirements *All relevant legislative, statutory, regulatory, contractual requirements and the organisation's approach to meet these requirements shall be explicitly identified, documented and kept up to date for each information system and the organisation.*	We discussed management of information security requirements in general terms with GenomeDK. We verified that Management-approved procedures are in place for handling legislative, statutory, regulatory and contractual requirements in relation to GenomeDK.	No exceptions noted.

5 Additional information from GenomeDK

The information included in this section is prepared by GenomeDK to provide the customer with further information. The section should not be regarded as a part of the system description. The information in this section is not covered by audit procedures performed to assess whether the system description gives a true and fair view, whether the controls supporting the control objectives presented in section 4 have been suitably designed and whether they operated effectively throughout the period. Thus, PwC's conclusion in section 2 does not cover the information in section 5.

GenomeDK has the following supplementary comments regarding the observations made by PwC:

- GenomeDK is continuously improving both technical and organizational security. Since the last assurance report, GenomeDK has further improved its information security management system and obtained an ISO 27001 certificate.
- GenomeDK has consistently worked towards its information security goals for 2024, including future-proofing the overall architecture of the system and making space for future expansions.
- GenomeDK is committed to ensuring stability and longevity by expanding the team of technical personnel. Leadership is considering multiple paths for hiring and retaining new talent.

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Erik Anders Dupont Børglum
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