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SRNL-RP-2020-00880

Surplus Plutonium Disposition Acceleration Scoping Study: Fast Flux Test Facility (FFTF) Material Direct Discard To WIPP

[redacted]

[redacted]

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[redacted]

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RECORD OF REVISIONS

Revision	Revision Date	Reasons for Revision
0	January 2021	Initial Issue

LIST OF ABBREVIATIONS AND ACRONYMS

AA	Accident Analysis
AEC	U.S. Atomic Energy Commission
AK	Acceptable Knowledge
AKSR	Acceptable Knowledge Summary Report
[redacted]	[redacted]
ANSI	American National Standards Institute
AROD	Amended Records of Decision
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
[redacted]	[redacted]
CBFO	DOE Carlsbad Field Office
CCC	Core Component Container
CCO	Criticality Control Overpack
CCP	Central Characterization Project
CFR	Code of Federal Regulations
[redacted]	[redacted]
CH-TRU	Contact Handled Transuranic Waste
CHA	Consolidated Hazards Assessment
[redacted]	[redacted]
CoC	Certificate of Compliance
[redacted]	[redacted]
CRA	Compliance Recertification Application
[redacted]	[redacted]
DFA	Driver Fuel Assembly
DID	Defense-in-Depth
[redacted]	[redacted]
DNN	Defense Nuclear Nonproliferation
DoD	Department of Defense
DOE	Department of Energy
DOE-SR	Department of Energy – Savannah River Site
DOT	U.S. Department of Transportation
DSA	Documented Safety Analysis
DU	Depleted Uranium
DWT	Difficult Waste Team

LIST OF ABBREVIATIONS AND ACRONYMS (cont)

[redacted]	[redacted]
EC	Environmental Compliance
EBR II	Experimental Breeder Reactor II
EEC	Environmental Evaluation Checklist
EM	DOE Office of Environmental Management
EPA	U.S. Environmental Protection Agency
EU	Enriched Uranium
[redacted]	[redacted]
FFTF	Fast Flux Test Facility
[redacted]	[redacted]
FPE	Fire Protection Engineering
[redacted]	[redacted]
FSD	Fire Scenario Document
FSS	Fire Suppression System
[redacted]	[redacted]
FY	Fiscal Year
GEV	General Electric Vallecitos
H_2O	Water
[redacted]	[redacted]
HEDL	Hanford Engineering Development Laboratory
HEU	High Enriched Uranium
HLW	High Level Waste
HPL	High Pressure Laboratory
[redacted]	[redacted]
HUFP	Hanford Unirradiated Fuel Package
HWFP	Hazardous Waste Facility Permit
[redacted]	[redacted]
IRT	[redacted] Commercial Fuel Pins
ITS	Important-to-Safety
k_{eff}	Effective Neutron Multiplication Factor
KAC	K Area Complex
KIS	K-Area Interim Surveillance
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LMFBRP	Liquid Metal Fast Breeder Reactor Program
[redacted]	[redacted]

LIST OF ABBREVIATIONS AND ACRONYMS (cont)

LR	Leakage Rate
[redacted]	[redacted]
LWA	Land Withdrawal Act
[redacted]	[redacted]
M&O	Management and Operations
M^3	Office of Material Management and Minimization
MFFP	MOX Fresh Fuel Package
[redacted]	[redacted]
MOX	Mixed Oxide
MR	Management Reserve
[redacted]	[redacted]
MSLD	Mass Spectrometer Leak Detector
MT	Metric Ton
[redacted]	[redacted]
N&CSE	Nuclear and Criticality Safety Engineering
N/A	Not Applicable
[redacted]	[redacted]
NCSE	Nuclear Criticality Safety Evaluation
NDU	No Defined Use
[redacted]	[redacted]
NEPA	National Environmental Policy Act
[redacted]	[redacted]
NMC&A	Nuclear Material Control and Accountability
NMED	New Mexico Environment Department
[redacted]	[redacted]
NNSA	National Nuclear Security Administration
[redacted]	[redacted]
NRC	U.S. Nuclear Regulatory Committee
NTP	National TRU Waste Program
NU	Natural or Normal Uranium
[redacted]	[redacted]
[redacted]	[redacted]
NWP	Nuclear Waste Partnership
[redacted]	[redacted]

LIST OF ABBREVIATIONS AND ACRONYMS (cont)

ONMI	Office of Nuclear Material Integration
ORNL	Oak Ridge National Laboratory
[redacted]	[redacted]
PA	Performance Assessment [redacted]
PCR	Permit Change Request
[redacted]	[redacted]
PFP	Plutonium Finishing Plant
[redacted]	[redacted]
PMR	Permit Modification Request
[redacted]	[redacted]
Pu	Plutonium
PVD	Programmatic Value Determination
QA	Quality Assurance
R&D	Research and Development
[redacted]	[redacted]
RAMPAC	Radioactive Materials Packages
RBD	[redacted] Carbide [redacted] Test Pins
RCRA	Resource Conservation Recovery Act
[redacted]	[redacted]
ROD	Record of Decision
ROM	Rough Order of Magnitude
[redacted]	[redacted]
RSO	Repository Science and Operations
[redacted]	[redacted]
S&S	Safeguards and Security
SS&ES	Safeguards, Security and Emergency Services
SA	Safety Analysis or Supplement Analysis
SAR	Safety Analysis Report
SARP	Safety Analysis Report for Packaging
SB	Safety Basis
SBS	Safety Basis Strategy
SC	Safety Class
SCD-11	Source and Compliance Document "CONSOLIDATED HAZARD ANALYSIS PROCESS (CHAP) PROGRAM AND METHODS MANUAL"
[redacted]	[redacted]

LIST OF ABBREVIATIONS AND ACRONYMS (cont)

SEIS	Supplemental Environmental Impact Statement
[redacted]	[redacted]
SHCS	Socket Head Cap Screw
[redacted]	[redacted]
SMP	Safety Management Program
[redacted]	[redacted]
SNL	Sandia National Laboratory
[redacted]	[redacted]
SPD	Surplus Plutonium Disposition
SRA	Shipper Receiver Agreement or Security Risk Assessment
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SS	Safety Significant or Stainless Steel
SWE	Solid Waste Engineering
TBD	To Be Determined
TC	Toxicity Characteristics
[redacted]	[redacted]
TRU	Transuranic
TRUCON	TRUPACT-II Content Code
TRUPACT	Transuranic Package Transporter
TSR	Technical Safety Requirements [redacted]
[redacted]	[redacted]
U	Uranium
[redacted]	[redacted]
U.S.	United States
[redacted]	[redacted]
VA	Vulnerability Assessment
[redacted]	[redacted]
WA	Work Authorization
WAC	Waste Acceptance Criteria
WAP	Waste Analysis Plan

LIST OF ABBREVIATIONS AND ACRONYMS (cont)

[redacted] [redacted]
WIPP Waste Isolation Pilot Plant
[redacted] [redacted]

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Prepared By:

Deanna Stimac

Digitally signed by Deanna Stimac
Date: 2021.01.13 11:20:41 -05'00'

Deanna Stimac — **Date**
Advisory Program Manager
Nuclear Materials Management
Savannah River National Laboratory

Technical Reviewer:

Jeffrey S. Allender

Digitally signed by Jeffrey S. Allender
Date: 2021.01.14 07:16:56 -05'00'

Dr. Jeffrey S. Allender — **Date**
Advisory Scientist
Nuclear Materials Management
Savannah River National Laboratory

Approval:

William F. Bates

Digitally signed by William F. Bates
Date: 2021.01.14 12:29:36 -05'00'

William F. Bates — **Date**
Deputy Associate Laboratory Director
Nuclear Materials Management
Savannah River National Laboratory

FFTF Direct-Discard Study Team/Contributing Members:

Jeff Allender (SRNL)
Dan Leduc (SRNL)
Chris Amos (SRNS)
Kerri Crawford (SRNS)
Katie Davis (SRNS)
Ken Fuller (SRNS)
Jeff Jordan (SRNS)
Bob Hall (ORNL)
Rose Montgomery (ORNL)
Paul Shoemaker (SNL)
Phil Theisen (SNL)

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EXECUTIVE SUMMARY

The Department of Energy (DOE) Office of Environmental Management (EM) and the National Nuclear Security Administration's (NNSA) Defense Nuclear Nonproliferation (DNN) Office of Material Management and Minimization (M3), through the Surplus Pu Disposition (SPD) Program, are leading an effort to accelerate disposition of surplus plutonium (Pu) currently residing in the state of South Carolina. The SPD Program will be using an approach known as Dilute and Dispose to process at least 34 metric tons (MT) of Pu into a form that can be safely and securely disposed of in the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. Currently, EM is implementing this Dilute and Dispose approach on a group of plutonium materials categorized in the "up to 6MT" grouping that includes a subset of materials received into the Savannah River Site (SRS) from Hanford in 2009 as part of the deinventory of the Hanford Plutonium Finishing Plant (PFP). This select surplus, unirradiated legacy nuclear fuel, designated as Fast Flux Test Facility (FFTF) material, has been stored in [redacted] Hanford Unirradiated Fuel Packages (HUFPs) in the K Area Complex (KAC) pending disposition.

In August 2019, the NNSA partnered with EM and tasked the Savannah River National Laboratory (SRNL) with leading a Scoping Study for Direct-Discard of the FFTF material in the current packaging to WIPP as an alternative to implementing a project to provide the capability for unirradiated fuel assembly disassembly, pin disassembly, and mixed oxide (MOX) pellet processing to make the materials compatible with the Dilute and Dispose down blend process. A collaborative Study team was formed consisting of SRNL, Sandia National Laboratory, and Oak Ridge National Laboratory personnel. For this phase of the Study, the team was directed to [redacted] focus on technical feasibility until DOE is ready to pursue the other stakeholder challenges associated with such a project.

This report documents the scope and results of the Direct-Discard Study for the Hanford FFTF Materials at SRS. Important points provided in the report are given below.

1. Programmatic Value Determination (PVD) - A PVD Request form was prepared for the Hanford FFTF Driver Fuel Assemblies (DFAs), pins, and insulators by SRNL [redacted] The PVD Request was subsequently routed to [redacted] by the Office of Nuclear Material Integration (ONMI) to obtain their concurrence that none of the materials were desirable [redacted] Concurrence with the PVD [redacted] is pending at this time while they determine if their programs would like to assume ownership of any of the materials for potential future [redacted] application.

2. Defense Determination - In order to support direct-discard of the HUFP packages of FFTF materials to WIPP as a potential new SRS waste stream, a Defense Determination documentation package must be prepared, evaluated and approved by the DOE Carlsbad Field Office (CBFO) Manager and General Counsel. The documentation must substantiate that the material within the HUFP packages was related to "atomic energy defense activities" for it to be accepted into WIPP. Based on the preliminary review that has been prepared for this potential SRS "Hanford Unirradiated Legacy Fuel Assemblies, Pins and Pin Material" waste stream using precedent that established defense determinations accepted previously from the DOE Headquarters Office of General Counsel, the material, that would be recategorized as waste, is expected to meet the requirements as in part defense based on the criteria established in the Nuclear Waste Policy Act and the WIPP Land Withdrawal Act. Contingent upon authorization, the HUFP Defense

Determination activities can continue in [redacted], with final negotiation with CBFO and approval of the Defense Determination package secured in [redacted]. The projected cost estimate of SRNL activities to support the resolution of the Hanford Unirradiated Legacy Fuel Assemblies, Fuel Pins, and Pin Material Defense Determination documentation are included within the [redacted] defined for technical support and project management as part of the Maintenance Strategy cost estimate. DOE-EM will also need to provide funding to the CBFO to support the waste stream Acceptable Knowledge Summary Report (AKSR) development by the Central Characterization Program (CCP); the amount of funding needed to support this activity will need to be determined based on negotiations outside of this Study. Savannah River Nuclear Solutions (SRNS) TRU Waste Program costs are expected to be covered by the site-level TRU Waste Program funding.

3. HUFP U.S. Nuclear Regulatory Commission (NRC) Format Safety Analysis Report (SAR) – For the HUFP packages to be accepted for receipt into WIPP, the NRC will need to recognize a DOE-EM certification or provide a license for the HUFP package use as a Type B Package. The NRC certifies that WIPP's specially designed Type B shipping casks are safe to transport TRU waste. SRNL Packaging & Systems Technology developed a preliminary HUFP licensing and certification estimate to prepare a new, NRC-format SAR to be submitted to the NRC based on the EM-licensed HUFP Safety Analysis Report for Packaging (SARP). The estimate involves approximately [redacted] hours of scope and would require [redacted] for development of the SAR, pre-submittal meetings, travel, response to regulatory questions and other applicant actions required to obtain an NRC certification. The estimate assumes no new cask testing is required but does include some funding for limited analyses updates. This preliminary estimate does not include Management Reserve (MR) or additional contingency. Coupled to the SRNL costs, the NRC-associated review costs will range from approximately [redacted] based on a [redacted]-hour review cycle.

4. HUFP Maintenance Approach - For the HUFP packages to be considered qualified Type B packages for shipment, the existing DOE certified HUFP SARP requires that prior to shipment of a loaded HUFP, the center O-ring seal, the vent port seal washer and the fill port seal washer shall be leak tested. Annual maintenance/periodic leakage rate tests may be performed as an option, in lieu of the pre-shipment leakage rate tests. Although a new HUFP SAR will be submitted to the NRC to support the receipt of the HUFPs into WIPP, the maintenance and leak test requirements are expected to remain the same. The maintenance/leak test effort will require the HUFPs to be removed from the [redacted] storage area for inspection and maintenance, and then loading onto [redacted] transport vehicle for shipment. The preferred location for performing the maintenance is [redacted] To accommodate these maintenance and shipping activities, existing site hardware, some of it originating from the initial FFTF loading into the HUFP at Hanford, and some of it from the HUFP receipt and storage at SRS, as well as a limited amount of new hardware to be fabricated/procured will be used. Assistance from the SRNL High Pressure Laboratory (HPL) will be needed to fabricate and operate a suitable package leak test skid. Personnel to be engaged to support the preparation for and implementation of the maintenance activities will include SRNL Packaging & Systems Technology, SRNL High Pressure Laboratory, K Area Engineering, Site Maintenance & Rigging, K Area Radiological Protection, K Area Operations, and SRS Procurement. Contingent upon completion of other required site and WIPP-related support activities, the HUFP maintenance and shipping activities are projected to commence in [redacted], occurring one HUFP at a time, and staggering the package evolutions to ensure emplacement

distribution as desired by WIPP. The projected cost estimate to support the HUFP maintenance, inspection and shipping activities is approximately [redacted], not including peripheral tasks such as the HUFP SAR preparation and KAC Documented Safety Analysis (DSA) revision. This approach will result in [redacted] HUFP shipments to WIPP [redacted]

5. KAC Safety Basis Strategy - The current KAC Safety Basis (SB) authorizes the storage of the FFTF in the HUFPs. The maintenance/leak test effort would require the HUFPs to be removed from the [redacted] storage area for inspection and maintenance, and then to be loaded onto [redacted] transport vehicle for shipment. To accommodate these maintenance and shipping activities, a revision of the KAC SB will be required. For the development of these SB changes, supporting documents will need to be completed. The SB supporting documents that are typically needed for SB changes are a Consolidated Hazards Analysis (CHA), Accident Analysis (AA) calculations, and Nuclear Criticality Safety Evaluations (NCSEs). A revision to the existing Fire Scenario Document (FSD) and other Fire Protection Engineering (FPE) documents is also anticipated. Development of the DSA and Technical Safety Requirements (TSR) revisions could commence in [redacted] to support the goal of beginning HUFP shipments from the KAC in [redacted]. To accelerate this timeline, these safety basis changes could be coupled to other DSA Rev. [redacted] changes or implemented ahead of the projected SPD DSA Rev. [redacted] scope. The projected cost estimate to support the DSA/TSR work to be performed by the Nuclear and Criticality Safety Engineering (N&CSE) organization is approximately [redacted]. An additional [redacted] will also be incurred by Operations, Engineering and various support groups to complete the review and implementation of the changes.

6. KAC Security Strategy - The Hanford FFTF material has been stored in the original HUFPs [redacted] since originally received in 2009. Direct shipment of this material to the WIPP will require the HUFPs to be removed from the [redacted] storage area for inspection, maintenance and loading onto [redacted] transport vehicle for shipment. [redacted] There is no increased security risk by removing the HUFPs from the [redacted]. As this project scope matures, additional analyses may be necessary. A detailed Security Risk Assessment (SRA) will be necessary to document final risks and security measures should this activity be authorized.

7. K-Area National Environmental Policy Act (NEPA) Coverage – Based on a Preliminary NEPA review that SRNS has initiated, the existing SPD Supplemental Environmental Impact Statement (SEIS) (DOE/EIS-0283-S2), Record of Decision (ROD) and Amended Records of Decision (ARODs) allow for the direct discard of the FFTF material to WIPP with a secondary option of down blending the materials if direct-discard is not available. The Supplement Analysis (SA) for the Storage of Surplus Pu Materials at SRS (DOE/EIS-0229-SA-4) might also allow for maintenance to be performed upon the cask as part of the storage scope but it will need to be formally reviewed. Based on the preliminary review noted above, at this phase of the Study, it is assumed that further SRNS Environmental Compliance (EC) support is considered Level-of-Effort and will be funded under site EM Program funding.

8. WIPP NEPA Coverage - Some type of NEPA evaluation is envisioned for WIPP to authorize the FFTF Direct Discard scope; an Environmental Evaluation Checklist (EEC) performed by WIPP may be all that is required. EM-HQ may need to include coverage of both the SRS and WIPP activities in a common, HQ-approved NEPA document. [redacted] The FFTF Direct Discard Study cost and schedule estimates therefore do not yet include this scope in the projections.

9. WIPP Performance Assessment (PA) – Sandia National Laboratory (SNL) confirmed with the WIPP PA analyst at Los Alamos National Laboratory (LANL) that SRS' Hanford FFTF material was included within the "up to 6MT" surplus plutonium scope that was part of the Impact Assessment for the WIPP Compliance Recertification Application that was delivered to the Environmental Protection Agency (EPA) in March 2019 as supplemented by the Compliance Recertification Application 2019 Appendix MASS in December 2019. The Assessment does not take credit for the containers that the FFTF material is packaged in but it does continue to screen criticality out for the material based on the post-emplacement criticality analysis for the materials in CCOs. The Compliance Recertification Application process requires a renewal application every five years; therefore, a new application will be initiated in [redacted] for approval by the [redacted] timeframe. To be successful, direct discard of the HUFPs containing the FFTF materials will have to remain consistent with the existing PA approach. [redacted]

10. WIPP Nuclear Criticality Safety Evaluation – ORNL completed development of a scope-of-work and estimate in January 2020 to perform an analysis that will evaluate the post-emplacement criticality of the HUFPs with FFTF material content at WIPP. The analysis will consider the initial conditions of disposal as well as potential conditions that may exist throughout the disposal analysis period (e.g., initial emplacement, room closure and package compaction, and long-term package degradation). The expected duration for the analysis work scope is [redacted] with a funding request of [redacted]. [redacted]

11. WIPP Safeguards/Waste Acceptance Criteria (WAC) Negotiations – [redacted] A safeguards strategy for WIPP for receipt, handling and emplacement activities will be required. DOE-EM expects to consult with EM 3.114 and DOE Safeguards, Security and Emergency Services (SS&ES) to engage the appropriate authority for directing that a WIPP Safeguards Strategy scope and estimate be developed, potentially by SRNS SS&ES. An additional review of the WIPP Safeguards Strategy may be required by the [redacted] as well. The FFTF Direct Discard Study cost and schedule estimates therefore do not yet include this scope in the projections.

Likewise, negotiations remain to be performed regarding explicit Contact Handled TRU (CH-TRU) requirements for WIPP certification [redacted]. Characterization and certification elements will be negotiated during development of the AKSR. [redacted] An Alternate Certification Strategy may be required to address characterization methods normally employed. The Difficult Waste Team (DWT) could be consulted in development of a strategy for certification of the Hanford Unirradiated Legacy Fuel Assemblies, Fuel Pins, and Pin Material waste stream from SRS. Funding will need to be provided to the CBFO for the waste stream support by CCP and/or the DWT; the amount of funding needed to support this activity will need to be determined based on negotiations outside of this Study. SRNS TRU Waste Program costs are expected to be covered by the site-level TRU Waste Program funding.

12. SRS Scope Cost Rollup - The estimates included in this Study are ROM budget placeholders. As ROM estimates, the fidelity is most accurate for the near-term portion of the activities. Thus, if the activities are authorized as a project, it is expected that estimates would again be refined, and resource loaded to better reflect the next steps. Funding is assumed to be available in [redacted] to initiate the project. [redacted] Additional costs will be incurred by DOE in the amount of funding needed to support CCP in the development of the waste stream AKSR, WIPP Security Strategy, WIPP Operations preparation for the HUFP receipt and handling, and possibly additional costs not yet envisioned at WIPP.

13. SRS Scope Preliminary Schedule – The Preliminary schedule proposed in this Study is predicated on a decision by EM to proceed with a project for direct discard of the HUFPs to WIPP by the second quarter of [redacted]. Assuming the necessary funding is also available, and negotiations with WIPP proceed favorably, the various tasks identified in the Study and above would proceed beginning in [redacted] and conclude in [redacted]. KAC would begin shipping the HUFPs to WIPP in [redacted] and conclude the shipping campaign in [redacted], thereby accelerating the removal of the materials from the state while avoiding additional expense by the government to prepare the FFTF materials for down blend for disposal.

1.0 INTRODUCTION

Select surplus, unirradiated legacy nuclear fuel, designated as Fast Flux Test Facility (FFTF) material, has been stored in [redacted] Hanford Unirradiated Fuel Packages (HUFPs) located at the Savannah River Site (SRS) in the K Area Complex (KAC) since receipt in 2009. The material is composed of unirradiated legacy fuel assemblies, pins, and pin materials, i.e., most as high quality surplus plutonium-bearing mixed oxide (MOX) material originally destined for fabrication into fuel components; archive materials returned to Hanford as part of the Plutonium Recycle Program, Mutual Defense Agreements, and Agreements for Cooperation with other countries; and materials from reactor fuel research, development and fabrication activities conducted at the Hanford 300 Area and, in particular, in the 308 Building in support of the FFTF and Experimental Breeder Reactor II (EBR II) activities. Materials remaining from the Hanford Engineering Development Laboratory (HEDL) 300 Area fuel fabrication development and production operations as well as materials returned to Hanford from the Department of Energy (DOE) contracted fuel fabrication vendors and materials returned to Hanford as part of the plutonium recycle programs were shipped to the Hanford Plutonium Finishing Plant (PFP) for vault storage for expected recovery. These materials were subsequently shipped to SRS for interim storage under DOE direction as an integral part of the Hanford PFP de-inventory mission in 2009. Based on surplus plutonium accelerated disposition strategies, this legacy material is being considered for direct shipment as transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP) in lieu of being downblended. [redacted]

FFTF Material Description

The material in the proposed SRS "Hanford Unirradiated Legacy Fuel Assemblies, Pins and Pin Material" waste stream is composed of unirradiated legacy fuel assemblies, pins, and pin materials, i.e., most as high quality surplus plutonium-bearing mixed oxide material originally destined for fabrication into fuel components; archive materials returned to Hanford as part of the Plutonium Recycle Program, Mutual Defense Agreements, and Agreements for Cooperation with other countries; and materials from reactor fuel research, development and fabrication activities conducted at the Hanford 300 Area and, in particular, in the 308 Building in support of the FFTF and EBR II activities performed as research and development (R&D) under the U.S. Atomic Energy Commission (AEC) Liquid Metal Fast Breeder Reactor Program (LMFBRP), as well as at a number of offsite reactors. The materials have not been introduced into a reactor core but were fabricated to provide testing capability for the Advanced Reactor Program. Materials remaining from the HEDL 300 Area fuel fabrication development and production operations as well as materials returned to Hanford from the DOE-contracted fuel fabrication vendors during their shutdown and cleanout at the close of the FFTF contracts, and materials returned to Hanford as part of the Plutonium Recycle Program, Mutual Defense Agreements, and Agreements for Cooperation with other countries were shipped to the Hanford PFP for vault storage for expected recovery. In 2009, these unirradiated legacy materials were packaged in [redacted] HUFP shipping containers and shipped to SRS for interim storage under DOE direction as an integral part of the Hanford PFP de-inventory mission. [redacted]

[redacted]

[redacted] The total plutonium within the [redacted] HUFP casks containing the Hanford legacy fuel components at SRS is approximately 0.7 metric ton (Pu elemental weight) [redacted]. A general summary of the legacy fuel materials contained within the [redacted] HUFP containers of the waste stream follows:

- [redacted] unirradiated Driver Fuel Assemblies (DFAs) from the FFTF program
- [redacted] unirradiated DFAs from the FFTF program that contain residual sodium surface contamination. [redacted]
- [redacted] unirradiated fuel pins from the FFTF program; HEDL development and fabrication activities; DOE-contracted fuel fabrication site returns; Plutonium Recycle Program, Mutual Defense Agreements, and Agreements for Cooperation returns; packaged within IDENT-69G pin containers

The Standard FFTF DFA is a hexagonal shaped component, that is composed of a bundle of 217 fuel pins, a surrounding duct, a shield orifice, an inlet nozzle, load pads, and a handling socket. The assembly is 12 feet long (3.6 m), 4.575 inches wide (11.6 cm) across the hexagon flats, 5.16 inches wide (13.1 cm) across the hexagon points and weighs a nominal 381 pounds (173 kg). There are four types of DFAs – Type 3.1, Type 3.2, Type 4.1 and Type 4.2 - with variability in the Pu content, Pu enrichment and quantity and type of uranium (natural or depleted) in the fuel core and insulator pellets amongst the types. DFAs Type 3.1 and 3.2 contain natural uranium (0.0711 wt% 235U), and DFAs Type 4.1 and 4.2 contain depleted uranium (0.02 wt% 235U). The fuel grade plutonium oxide – uranium oxide loading of a nominal DFA and fuel pin is provided in Table 1.1.

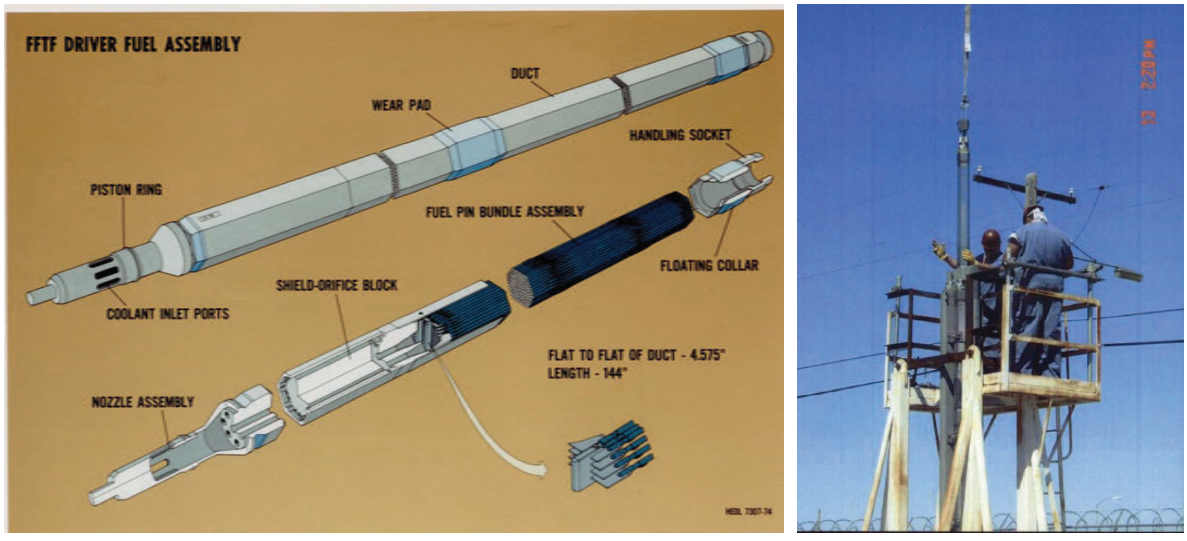
Table 1.1 FFTF Driver Fuel Assembly Plutonium and Uranium Content

Driver Fuel Assembly Type	3.1	3.2	4.1	4.2
Plutonium				
Enrichment, %Pu/(Pu+U)	27.37	22.43	29.28	25.14
Assembly content (kg)	9.071	7.421	9.722	8.333
Fuel Pin Content (g)	41.8	34.2	44.8	38.4
Isotopic fraction				
239Pu	0.8696	0.8696	0.8711	0.8711
240Pu	0.1173	0.1173	0.1163	0.1163
241Pu	0.0104	0.0104	0.0102	0.0102
Uranium*				
Enrichment, %U/(Pu+U)	72.63	77.57	70.72	74.86
Assembly content (kg)	24.07	25.666	23.481	24.813
Fuel Pin Content (g)	110.9	118.3	108.2	114.3
Isotopic fraction				
235U	0.007	0.007	0.002	0.002
238U	0.993	0.993	0.998	0.998

*Excludes the uranium in the two insulator pellets within each fuel pin, at the top and bottom of the fuel column. Each assembly holds nominally 1.5 kg of uranium in the insulator pellets.

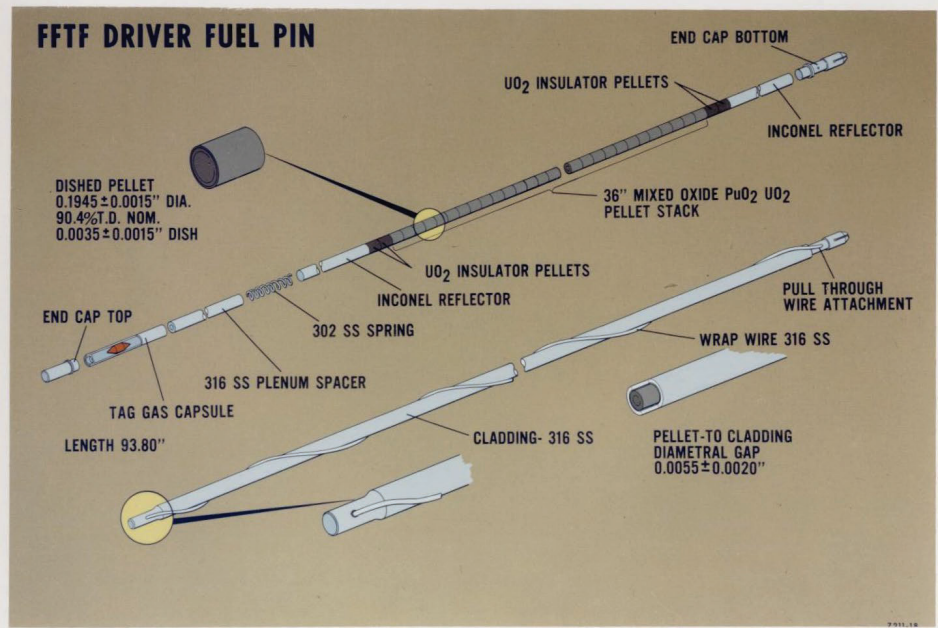
An example of an FFTF DFA is provided in Figure 1.1.

Figure 1.1 FFTF Driver Fuel Assembly



An example of an FFTF Driver Fuel Pin is provided in Figure 1.2.

Figure 1.2 FFTF Driver Fuel Pin



[redacted] of the unirradiated DFAs of the proposed waste originated from the FFTF and contain ~75% of the unirradiated fuel pins. Approximately 86% of the unirradiated loose fuel pins in IDENT-69G containers also originated from the FFTF but are not configured into assemblies. The unirradiated legacy loose fuel pins that are packaged in [redacted] IDENT-69G containers are composed of a variety of different types of pins based on their nuclear material content, original intended use, source of fabrication, and fuel pin configuration. The fuel pins contain pellets, and, with few exceptions, the pellets are sintered Pu-uranium mixed oxide that were fabricated for use as reactor fuel. [redacted]. Table 1.2 provides a breakdown of the categories of unirradiated legacy loose fuel pins in the IDENT-69G containers.[redacted]

Table 1.2 Fuel Pin Categories in IDENT-69G Containers

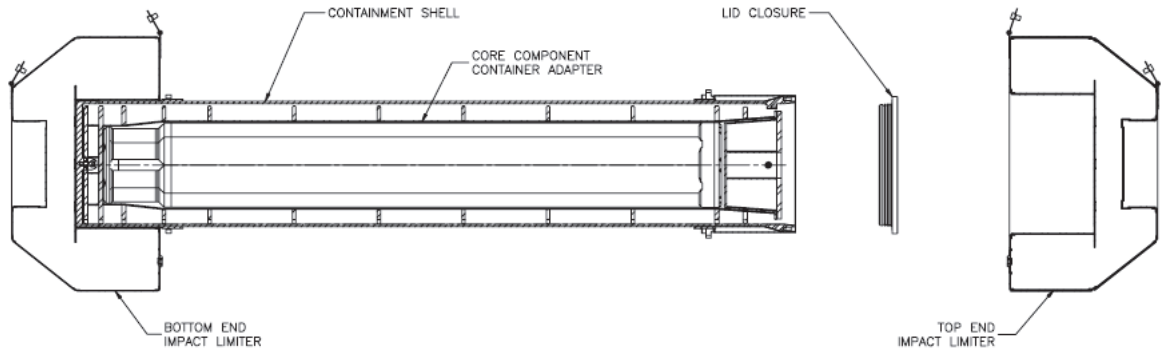
Pin Categories and Number of Pins	
Category	Number of Pins
[redacted]	
DFA (Driver Fuel Assembly pins)	[redacted]
TES (MOX Test Pins for Fuel Assemblies) [redacted]	[redacted]
HEU (High Enrichment Uranium-[redacted]	[redacted]
LEU ([redacted] Low Enrichment Uranium [redacted])	[redacted]
RBD ([redacted] Carbide [redacted] Test Pins)	[redacted]
[redacted]	
PLS (Fuel Pellet Stacks [redacted])	[redacted]
EBR (Experimental Breeder Reactor II Fuel Pins)	[redacted]
[redacted]	[redacted]
IRT ([redacted] Commercial Fuel Pins)	[redacted]
GEV (General Electric Vallecitos Pin)	[redacted]
Total number of unirradiated legacy loose pins	[redacted]

The HUFP material, if designated as waste, is not subject to the DOE-STD-3013 pathway for retention as product and is expected to be released for disposition as discardable material. In 1998, Section 308 of the Fiscal Year (FY) 1999 Energy and Water Development Appropriations Act[7] prohibited disposal of waste containing concentrations of plutonium "in excess of 20 percent by weight for the aggregate of any material category" (this prohibition was promulgated in subsequent Appropriations Acts such as Section 310 of the FY 2004 Appropriations Bill [H.R. 2754][8].

FFTF Packaging Description

The Hanford Unirradiated Legacy Fuel material was loaded by Hanford into Core Component Containers (CCCs), and shipped from Hanford to SRS in HUFPs (package model number USA/9905/B(U)F-96(DOE)) that were certified for use under Safety Analysis Report for Packaging (SARP) by DOE EM-60.[9] The HUFPs and their content are now proposed to be dispositioned as TRU waste by the DOE Office of Environmental Management (EM) at SRS. The HUFP is a stainless-steel cask that is 201.33 inches (16-ft 9.33-in) long with an outside diameter of 30 inches at the middle and 60 inches at each impact limiter end. Impact limiters are installed at each end of the HUFP body for impact force mitigation and thermal protection of the containment elastomeric seals. The HUFP has no component whose function is to provide biological shielding. The primary components of the HUFP are shown in Figure 1.3.

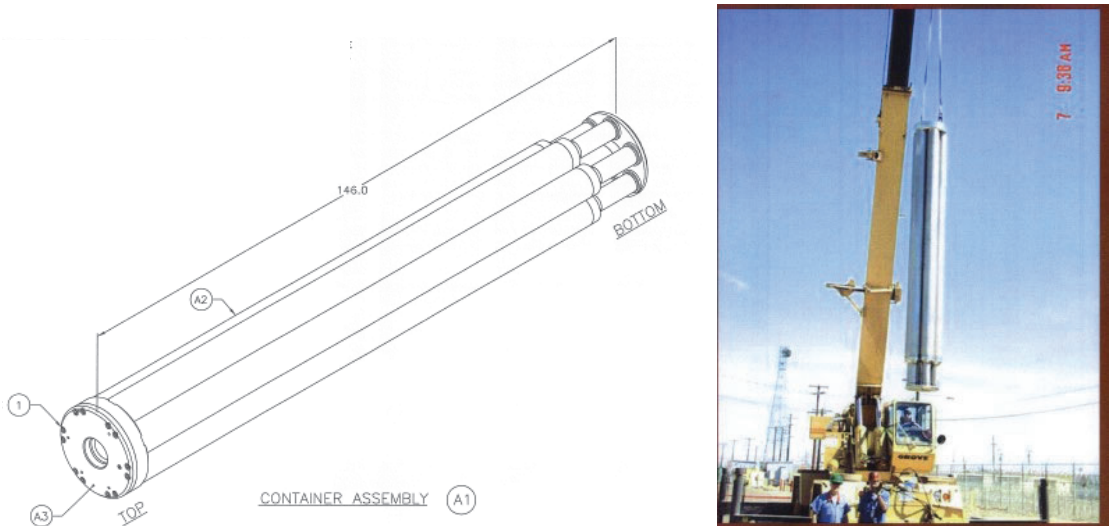
Figure 1.3 Major HUFP Components



The HUFP includes an austenitic stainless-steel cylindrical containment body and closure lid that provide leak-tight containment for a payload of up to seven DFAs or six IDENT-69G containers within a CCC. The CCC is an unshielded closed container that provides further robust containment of the content in the

HUFP. The CCC is supported during transportation by the CCC-Adapter. The CCC provides long-term handling capability, retrievability, and geometry control for the content. The CCC consists of a ring of six radial storage tubes spaced around a center storage tube. The inner diameter of each of the tubes is 6.41 inches. The outer diameter of the CCC is 20 inches with a total length of 148 inches (12 feet – 4 inches). The CCC is fabricated from stainless steel and nickel alloy materials to provide a long-term corrosion resistant fuel storage container. The CCC design provides six separate bottom-sealed tubes clustered around a central support tube. Each of the six outer tubes is capable of storing either a DFA or an IDENT-69G pin container.

Figure 1.4 Core Component Container



The maximum permissible gross shipping weight of the HUFP is 14,000 pounds, including maximum payload, body, CCC-Adapter, and impact limiters. The maximum total activity of the payload is 400,000 Ci, and the maximum quantity of fissile constituents (i.e, U-235, Pu-239, and Pu-241) is 120 kg. The maximum decay heat for the HUFP is 400 watts, based on seven (7) DFAs. Table 1.2 provides the SARP packaging and content weight allowances.

Table 1.3 HUFP Weight and Center of Gravity

[redacted]

The IDENT-69G Fuel Pin Storage Container is a two-piece stainless steel unit consisting of the storage unit and plug assembly. Overall length of the IDENT-69G is approximately 144 inches (12 feet) with an outside diameter of 5.75 inches. [redacted]

An example of an IDENT-69G Fuel Pin Container is provided in Figure 1.5.

Figure 1.5 IDENT-69G Fuel Pin Container

[redacted]

The specific DFA identifier, DFA position within each CCC, and detailed and summary data on the fuel pins that have been loaded into the IDENT-69G containers, and their respective CCCs, and HUFP containers can be found in [redacted] and [redacted].

1.1 Study Goals

This summary report provides an unclassified evaluation of the SRS scope of work required to perform disposition of the surplus, legacy Hanford FFTF materials at WIPP without SRS processing or repackaging of the material and with limited existing storage container manipulation. The preferred disposition approach will consider a holistic approach that balances regulatory requirements, expedited removal of the material from the State of South Carolina, budgetary allocations and constraints, and most importantly, the benefits of reduced potential exposure to the workforce. The goal of this Study is to provide the DOE and National Nuclear Security Administration (NNSA) with a feasibility evaluation, including estimates and schedules for subsequent effort so that the EM Nuclear Materials Stabilization Program can determine the preferred approach for an accelerated disposition path for the legacy Hanford FFTF materials.

1.2 Study Scope

The Work Authorization (WA) for this Study [redacted] identified six specific topical areas to be evaluated. For this phase of the Study, [redacted] the evaluation consisted of primarily work scope at SRS to support implementation of the direct discard disposition approach. The Study topical areas were slightly expanded as the Study progressed to include other areas such as the WIPP Defense Determination and National Environmental Policy Act (NEPA) coverage.

1. HUFP Transport Licensing for Direct Disposal at WIPP - perform initial review of SARP and expected revision that will be required for the U.S. Nuclear Regulatory Commission (NRC) licensing.

i. U.S. Department of Transportation (DOT) certification (current) used as basis
ii. NRC licensing - required for WIPP acceptance
iii. HUFP inspection, maintenance and leak testing requirements - activities could involve direct shipment (no HUFP opening); inspection, maintenance and testing of outer HUFP containment only; or invasive exposure of actual content and inner containment. Determining the most probable requirements are crucial to evaluating subsequent steps (such as location) to perform the inspection, maintenance and testing.

2. Probability of Criticality in WIPP
   i. Review SARP criticality analysis.
   ii. Interface with Sandia National Laboratory (SNL) Performance Assessment (PA) staff on PA criticality assumptions, requirements and the Oak Ridge National Laboratory (ORNL) post emplacement criticality analysis.
   iii. Interface with Solid Waste Engineering (SWE) regarding WIPP Waste Acceptance Criteria (WAC) criticality requirements.
   iv. [redacted]

3. Potential for WIPP Documented Safety Analysis (DSA) Impacts
   i. Interface with Savannah River Nuclear Solutions (SRNS) SWE and SNL on anticipated impacts based on SARP and WIPP Criticality evaluations.

4. Programmatic Value Determination (PVD)
   i. Initiate development of draft PVD which will be required to dispose of FFTF fuel per DOE O 410.2

5. WIPP Performance Assessment Impacts
   i. Interface with SNL on PA analysis [redacted]

6. Safeguards & Security (S&S)/Vulnerability Assessment (VA) - perform evaluation as related to packaging and fuel details.

This report provides a summary of the Study work performed associated with SRS activities, and estimates and schedules for subsequent SRS effort. The Study team did not interface with and engage the technical, regulatory and operating organizations at WIPP; a related evaluation by these individuals will be required in order to fully detail the cost and schedule for direct discard of the legacy Hanford FFTF materials at WIPP.

1.3 Problem to Be Analyzed

As stated previously, SRS must disposition approximately 700 kg of surplus plutonium contained in Hanford unirradiated legacy fuel assemblies, pins, and pin materials, i.e., most as high quality surplus plutonium-bearing mixed oxide material originally destined for fabrication into fuel components; archive materials returned to Hanford as part of the Plutonium Recycle Program, Mutual Defense Agreements,

and Agreements for Cooperation with other countries; and materials from reactor fuel research, development and fabrication activities conducted at Hanford. The Surplus Plutonium Disposition (SPD) Supplemental Environmental Impact Statement (SEIS) (DOE/EIS-0283-S2)[13], Record of Decision (ROD)[14], and Amended Records of Decision (ARODs), allow for the direct discard of the materials to WIPP with a secondary option of down blending the materials if direct discard is not available. To expedite the material disposition, efficiently expend resources for the disposition, and to reduce overall personnel occupational exposure associated with the disposition, this Study evaluates some of the logistical scope to be performed at SRS to implement a direct discard of the legacy Hanford FFTF materials at WIPP.

2.0 STUDY ASSUMPTIONS

2.1 Programmatic

- The PVD will be approved and the DOE [redacted] will have no programmatic use for the Hanford FFTF materials.
- Co-mingling of materials within the HUFP containers is accepted as justification for the container content defense-related determination.

2.2 Transportation

- The NRC will recognize the previous HUFP physical testing results and require no new physical testing to authorize the HUFP SARP.
- The maintenance to be performed on the HUFP for re-certification will be non-invasive (CCC will not be required to be opened).
- Shipping of the HUFPs will occur [redacted].

2.3 Safeguards and Security

- [redacted]
- [redacted]
- The Hanford FFTF materials can be categorized as-is as [redacted] for an end state for Nuclear Material Control and Accountability (NMC&A).
- [redacted]

2.4 WIPP Requirements

- A WIPP Security Strategy for emplacement of the HUFPs within the rooms/panels can be developed and implemented.
- The impact limiters of the HUFPs can be removed at WIPP for movement and placement of the containers in the panels at WIPP.
- The direct-discard of the Hanford FFTF materials in the HUFPs can be addressed within the existing NEPA analyses for WIPP.
- [redacted]
- Nuclear Waste Partnership (NWP) Central Characterization Project (CCP) can develop an Acceptable Knowledge Summary Report (AKSR) for the SRS' "Hanford Unirradiated Legacy Fuel Assemblies, Pins and Pin Material" waste stream.

2.5 WIPP Criticality Safety

- The HUFPs, with impact limiters removed, will be emplaced among other packages (i.e., "random" placement) without special consideration for criticality safety.
- The WIPP post-emplacement criticality analysis will assume WIPP room closure compaction will result in the HUFP packages being pushed together as well as being deformed.
- Degraded geometry calculations for criticality safety will assume complete corrosion of the HUFP, potential changes in the DFA separation, and complete corrosion of the DFA and cladding.
- ORNL will be successful in generating a nuclear criticality safety evaluation (NCSE) for the HUFPs that supports continued screening of the post-emplacement criticality from the WIPP PA.

3.0 EVALUATION RESULTS

3.1 Programmatic Value Determination

As part of nuclear materials disposition planning, as outlined in DOE Order 410.2, *Management of Nuclear Materials*, and DOE Order 474.2, *Nuclear Material Control and Accountability*, nuclear materials can be dispositioned as waste provided there is no defined use for the material. The PVD process is used to determine if there is other programmatic interest or need for the material prior to disposition. Information from a variety of sources, including process knowledge, past experience, and guidance from the Office of Nuclear Material Integration (ONMI), support the determination of an appropriate disposition path for nuclear material that is no longer needed at a particular site, in accordance with applicable law and DOE Orders and policy. Available disposition pathways for nuclear material fall into the following broad categories: use at another DOE site or by a non-DOE government agency; retention for future use (i.e., National Asset Material); sale or other authorized transfer, or disposal as waste, perhaps at a different location. The disposition process is initiated when a Program "owner" (i.e., the program with current responsibility for use and/or management of the material), the DOE Field Element (i.e., site office), and holding site work together to make the determination that a material is no

longer needed at a particular site. If there is a pre-identified need for the material at another site, the two sites are expected to work together to transfer the material.

Generally, these inventories will be designated as No-Defined-Use (NDU) by the owner site in their annual Nuclear Materials Inventory Assessments and Nuclear Materials Management Plans and may also have a disposition path of To Be Determined (TBD), such as the Hanford FFTF materials at SRS.

Following the determination that the material is no longer required at the holding site or at a separate site, the holding site notifies ONMI and the appropriate Program Office via the PVD Request form. The form provides basic material characterization information to assist ONMI and the Program Office with determining whether the material has a use at another site or outside DOE.

DOE and NNSA also oversee disposition programs for legacy materials that have been removed from certain uses, e.g., weapons-usable fissile materials. The PVD process allows DOE to evaluate the potential use of the inventory within policy restrictions and assures that inventories are not permanently degraded before such use has been evaluated.

A PVD Request form was prepared for the Hanford FFTF DFAs, pins, and insulators by the Savannah River National Laboratory (SRNL) [redacted] on December 6, 2019[redacted]. The PVD Request was subsequently routed [redacted] by ONMI to obtain [redacted] concurrence that none of the materials were desirable for future [redacted] applications. Concurrence with the PVD [redacted] is pending at this time while they determine if their programs would like to assume ownership of any of the materials for future [redacted] application. A copy of the PVD is included in Appendix A to this document.

3.2 Defense Determination

Defense Determination Criteria

In order to support a DOE Accelerated Pu Disposition effort to direct-discard HUFPs of FFTF materials at WIPP, a Defense Determination documentation package must be prepared, evaluated and approved for this potential new SRS waste stream by the DOE Carlsbad Field Office (CBFO) Manager and General Counsel. For waste to be eligible for disposal at the WIPP, it must be determined that the waste in question was generated as a result of national defense and related cleanup activities. The Waste Isolation Pilot Plant Land Withdrawal Act (WIPP LWA)[16], as amended by the National Defense Authorization Act for Fiscal Year 1997[17], requires that TRU waste must have been generated by atomic energy defense activities of the DOE to be eligible for disposal at WIPP. The WIPP Transuranic WAC[18] requires generator sites to use acceptable knowledge (AK) to determine if the TRU waste streams to be disposed at WIPP meet the definition of TRU "defense" waste. Based on guidance from the DOE[redacted], TRU waste is eligible for disposal at WIPP If it has been generated in whole or part by one or more of the atomic energy defense functions listed in Section 10101(3) of the Nuclear Waste Policy Act of 1982, as amended,[21] based on Section 2011 et seq. of the Atomic Energy Act of 1954[22] follows:

- Naval reactors development
- Weapons activities, including defense inertial confinement fusion
- Verification and control technology

- Defense nuclear materials production
- Defense nuclear waste and materials by-product management
- Defense nuclear materials security and safeguards and security investigations
- Defense research and development

Wastes may be qualified as defense-related based on their origination in whole or in part from one of the above activities or the historical co-mingling of the waste with waste originating from one of the above activities, provided that it is not feasible to segregate the waste (i.e., into defense and non-defense portions) following co-mingling. These concepts have been vital to the defense determination for several waste streams disposed at WIPP. The defense determination documentation package to be prepared for the SRS "Hanford Unirradiated Legacy Fuel Assemblies, Pins and Pin Material" waste stream will take the approach applied by the Hanford site for debris and other mixed-oxide residues that they and several of their contracted fuel fabrication vendors have taken regarding defining a defense-related pedigree for legacy materials associated with the FFTF, HEDL, and LMFBRP.

Preliminary Defense Determination

[redacted]

Defense Determination Projected Schedule

[redacted]

[redacted]

[redacted]

- SRNL/SRNS begin informal negotiations of the preliminary Defense Determination documentation packet with the CBFO.
    - SRNL/SRNS continue development of the Defense Determination documentation for the Waste (includes justification and source documents substantiating defense related activities for the waste)
    - SRNL finalize the Transuranic Waste Defense Determination Approval Form and secure DOE-EM site rep and DOE-EM site chief counsel approval signatures
    - SRNL finalize the Defense TRU Waste Determination Checklist
- SRNL/SRNS provide input documentation (such as the Defense Determination) to NWP CCP for development of the AKSR
- CCP begins development of the Waste Stream AKSR as part of the National TRU Waste Program

[redacted]

- SRNL/SRNS finalize the Defense Determination submittal with the CBFO
    - Submit a formal letter to the U.S. DOE Carlsbad Field Office, Mr. Kenneth E. Princen, Assistant Manager, Office of the National TRU Program, requesting a formal review of the Defense Determination packet that includes the Transuranic Waste Defense Determination Approval Form with the appropriate signatures, the Defense TRU Waste Determination Checklist, and the Defense Documentation for the Waste
    - The CBFO conducts a technical evaluation of the Defense Determination submittal and submits comments for resolution
    - SRNL/SRNS resolve CBFO comments
    - CBFO National TRU Waste Program (NTP) Manager provides recommendation for approval or denial to Manager of the CBFO
    - CBFO Counsel and Manager concurrence signatures obtained
    - CBFO transmits a letter of approval or denial to the SRS TRU Waste Program
- CCP concludes development of the Waste Stream AKSR document

[redacted]

[redacted]

Defense Determination Projected Cost Estimate

[redacted]

3.3 HUFP NRC-Format Safety Analysis Report (SAR)

As stated previously, the HUFP packages were received into SRS under SARP [redacted] that was certified for use by DOE EM-60. For the HUFP packages to be accepted for receipt into WIPP, the NRC will need to recognize a DOE-EM certification or provide a license for the HUFP package use as a Type B Package. The NRC certifies that WIPP's specially designed Type B shipping casks are safe to transport TRU waste. The SRNL Packaging & Systems Technology representative on the Study team performed a preliminary evaluation of the feasibility of requesting an exemption to ship the HUFP casks in an expired maintenance condition, and recommends there is a higher probability of success with preparing a new NRC-format SARP to be submitted to the NRC using the EM-certified HUFP SARP as a basis. Using this approach, KAC may be able to perform limited maintenance and surveillance operations on the loaded HUFP casks for qualification for shipping. SRNL Packaging & Systems Technology developed a preliminary HUFP licensing and certification estimate provided as Figure 3.3.1 to prepare a new, NRC-format SAR to be submitted to the NRC based on the EM-licensed HUFP SARP. The estimate involves approximately [redacted] hours of scope and would require [redacted] for development of the SAR, pre-submittal meetings, travel, response to regulatory questions and other applicant actions required to obtain an NRC certification. The estimate assumes no new cask testing is required but does include some funding for limited analyses updates. This preliminary estimate does not include Management Reserve (MR) or additional contingency and is based on 2020 dollars. Coupled to the SRNL costs, the NRC-associated review costs will range from approximately [redacted] based on a [redacted] review cycle. It is possible that the existing NRC confirmatory analyses and experience with the MOX Fresh Fuel Package (MFFP) (active certificate is on Radioactive Materials Packages [RAMPAC] database) may accelerate the review process, resulting in lower overall NRC review costs. This approach is believed to have a higher probability of success over requesting and obtaining an exemption to ship the HUFP casks in an expired maintenance condition.

Figure 3.3.1 HUFP NRC-Licensed SAR Cost Estimate

3.4 K-Area HUFP Maintenance Approach

Anticipated HUFP Safety Analysis Report Maintenance Requirements

As denoted previously, it is anticipated that a new HUFP SAR will be submitted to the NRC to support the receipt of the HUFPs into WIPP but the maintenance and leak test requirements are expected to remain the same as those required in the SARP [redacted] From Chapter 8 of the SARP [redacted], the maintenance requirements include the following.

Containment Boundary Structural and Pressure Tests

The HUFP containment boundary of the [redacted] loaded containers was pressure tested to 125% of the design pressure per the requirements of American Society of Mechanical Engineers (ASME) Boil and Pressure Vessel Code, Section III, Subsection NB-6200 prior to being placed into service and loading. The HUFPs were transported to SRS and have been stored since their receipt in 2009. No on-going, repetitive loading and unloading or transport of the containers has occurred since then. In the SAR to be submitted, it is expected that the maintenance structural testing requirements will be qualified to be required when packaging has undergone repetitive use that may have challenged the original structural containment boundary qualification. Therefore, due to the limited handling and transport of the HUFPs containing the FFTF material at SRS, it is anticipated that no containment boundary structural pressure testing will be required. Accessible base material and welds directly related to the pressure boundary of the containment vessel will be visually inspected for plastic deformation or cracking in accordance with the statically loaded criteria of American Welding Society (AWS) D1.6, and, if necessary, liquid penetrant inspected per ASME Boiler and Pressure Vessel Code, Section V, Article 6, and ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NB, Article NB-5000. Indications of cracking or distortion will be recorded on a nonconformance report, dispositioned, and, as necessary, brought into compliance with the packaging general arrangement drawings prior to acceptance in accordance with the cognizant quality assurance program and the applicable ASME Code.

Seal Replacement and Containment Vessel Periodic Leakage Rate Testing

Containment vessel O-ring and washer replacement will be required as part of the packaging maintenance and periodic leakage rate testing. Maintenance and periodic leakage rate testing will be performed on the main O-ring seal, vent port seal, and fill port seal. Leakage rate testing following seal replacement shall meet the following *Maintenance/Periodic Leakage Rate Test Acceptance Criteria*:

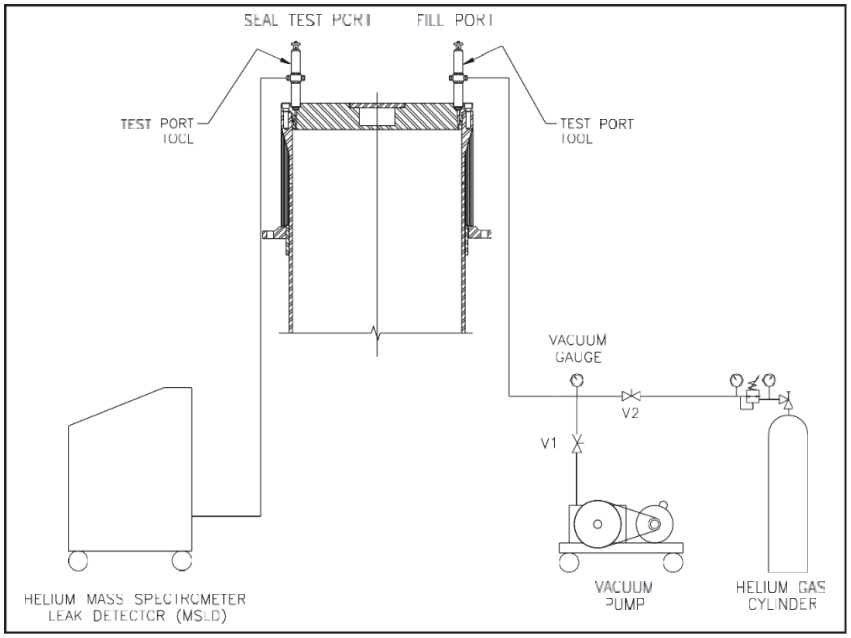
1. To be acceptable, each leakage rate test shall demonstrate a "leak-tight" leakage rate of 1×10^{-7} reference cubic centimeters per second (ref·cm^3/s), air, or less, per Section 6.3, *Application of Reference Air Leakage Rate (LR)*, of American National Standards Institute (ANSI) N14.5.

2. In order to demonstrate the leak-tight leakage rate, the sensitivity of the leakage rate test procedure shall be 5×10^{-8} cm^3/s, air, or less, per Section 8.4, *Sensitivity*, of ANSI N14.5.

Anticipated SAR Instructions For Helium Leakage Rate Testing of the Main O-ring Seal

1. The maintenance/periodic verification leak test of the HUFP containment O-ring seal integrity shall be performed following the guidelines of Section A.5.4, *Evacuated Envelope – Gas Detector*, of ANSI N14.5. A schematic diagram of the typical test setup is shown in Figure 3.4.1.

Figure 3.4.1 Typical Leak Test Skid



Note: The configuration shown in this figure is representative. Other configurations may be utilized.

2. Assemble the HUFP with the three O-ring seals installed in the closure lid. Ensure the vent, seal test, and fill port plugs are installed with their associated seal washers. The vent port plug also has an associated O-ring. Assembly is as shown on the drawings in the SAR Appendix, *Packaging General Arrangement Drawings*.
3. Utilizing a port tool, attach a vacuum pump and a source of helium gas, in parallel, to the fill port.
4. Close the valve to the source of helium gas and open the valve to the vacuum pump.
5. Utilizing a port tool, rotate the fill port plug to the open position.
6. Evacuate the system to a 90% vacuum or better (≤ 10% ambient atmospheric pressure). Isolate the vacuum pump from the system.
7. Provide a helium atmosphere inside the evacuated cavity by backfilling with helium gas (99% purity or better) to ambient atmospheric pressure (+1 psi, -0 psi).
8. Utilizing a port tool, rotate the fill port plug to the closed position, and remove the helium contaminated port tool from the fill port.

9. Install a clean (helium-free) port tool into the seal test port.
10. Utilizing appropriate fittings, attach a helium mass spectrometer leak detector (MSLD) to the port tool.
11. Utilizing the port tool, rotate the seal test port plug to the open position.
12. Evacuate the cavity above the lid containment O-ring seal until the vacuum is sufficient to operate the leak detector per the manufacturer's recommendations.
13. Perform the helium leakage rate test to the requirements of the *Maintenance/Periodic Leakage Rate Test Acceptance Criteria*. If, after repeated attempts, the HUFP containment O-ring seal fails to pass the leak test, isolate the leak path and, prior to repairing the leak path and repeating the leak test, record on a nonconformance report and disposition prior to final acceptance in accordance with the cognizant quality assurance program.

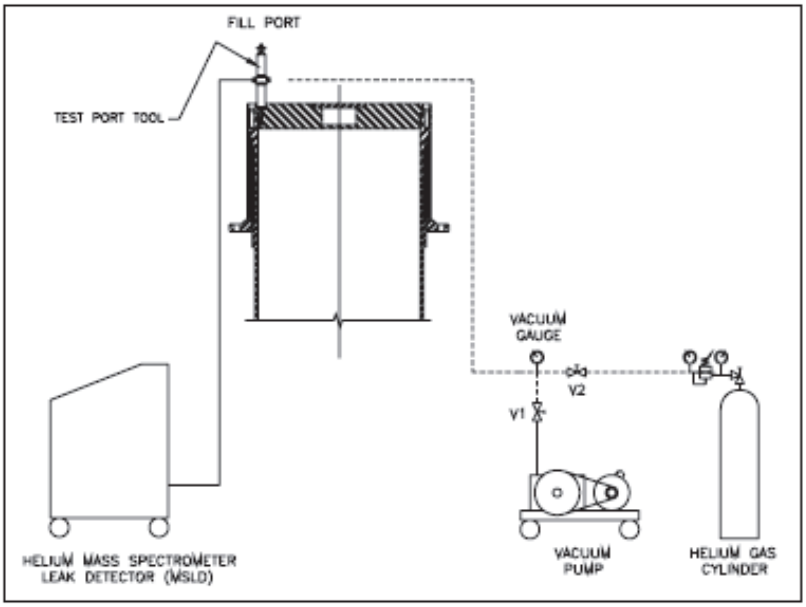
Anticipated SAR Instructions For Helium Leakage Rate Testing of the Vent Port Plug Seal Washer

1. The maintenance/periodic verification leak test of the HUFP vent port plug containment seal washer integrity shall be performed following the guidelines of ANSI N14.5, Section A.5.4, *Evacuated Envelope – Gas Detector*. The test setup is again represented by that shown in Figure 3.4.1.
2. The HUFP shall be assembled with all three O-ring seals installed on the closure lid. Ensure the vent, seal test, and fill port plugs are installed with their associated seal washers. The vent port plug also has an associated O-ring. Assembly is as shown on the HUFP drawings in the SAR Appendix, *Packaging General Arrangement Drawings*.
3. Verify the presence of a helium atmosphere below the vent port plug containment seal washer, as specified above in Steps 3 – 8 of the above section for *Helium Leakage Rate Testing of the Main O-ring Seal*.
4. Install a port tool into the vent port.
5. Utilizing appropriate fittings, attach a helium MSLD to the port tool.
6. Evacuate the cavity above the vent port plug containment seal washer until the vacuum is sufficient to operate the leak detector per the manufacturer's recommendations.
7. Perform the helium leakage rate test to the requirements of the *Maintenance/Periodic Leakage Rate Test Acceptance Criteria*. If, after repeated attempts, the vent port plug containment seal washer fails to pass the leak test, isolate the leak path and, prior to repairing the leak path and repeating the leak test, record on a nonconformance report and disposition prior to final acceptance in accordance with the cognizant quality assurance program.

Anticipated SAR Instructions For Helium Leakage Rate Testing the Fill Port Plug Seal Washer

1. The maintenance/periodic verification leak test of the HUFP fill port plug containment seal washer integrity shall be performed following the guidelines of Section A.5.4, *Evacuated Envelope – Gas Detector*, of ANSI N14.5. A schematic diagram of the typical test setup is shown in Figure 3.4.2.

Figure 3.4.2 Typical Fill Port Leakage Test Skid



Note: The configuration shown in this figure is representative. Other configurations may be utilized.

2. The HUFP shall be assembled with all three O-ring seals installed on the lid. Ensure the vent, seal test, and fill ports are installed with their associated seal washers. The vent port plug also has an associated O-ring. Assembly is as shown on the HUFP drawings in the SAR Appendix, *Packaging General Arrangement Drawings*.
3. Verify the presence of a helium atmosphere below the fill port plug containment seal washer, as specified above in Steps 3–8 of the above, *Helium Leakage Rate Testing the Main O-ring Seal*.
4. Install a port tool into the fill port.
5. Utilizing appropriate fittings, attach a helium MSLD to the port tool.
6. Evacuate the cavity above the fill port plug containment seal washer until the vacuum is sufficient to operate the leak detector per the manufacturer's recommendations.
7. Perform the helium leakage rate test to the requirements of the *Maintenance/Periodic Leakage Rate Test Acceptance Criteria*. If, after repeated attempts, the HUFP fill port plug containment seal washer fails to pass the leak test, isolate the leak path and, prior to repairing the leak path and repeating the

leak test, record on a nonconformance report and disposition prior to final acceptance in accordance with the cognizant quality assurance program.

Additional HUFP Component Inspection and Material Tests

Fasteners

All threaded components to be accessed will be visually inspected for deformed or stripped threads. Damaged threaded components will be repaired or replaced prior to further use. The threaded components to be visually inspected include the containment lid bolts, vent port plug, fill port plug, seal test port plug, core component container adapter (CCC-Adapter) lid bolts, CCC lid bolts, and impact limiter bolts.

Seal Area Routine Inspection and Repair

At the time of seal replacement, the sealing surfaces on the closure lid and body will be visually inspected for damage that could impair the sealing capabilities of the HUFP. Surface finish inspections will be performed for the body upper forging, the O-ring grooves and the sealing surfaces on the closure lid. Damage will be repaired (e.g., using emery cloth or other surface finishing techniques) to restore the sealing surfaces to the surface finish specified in the SAR, *Surface Finish of Sealing Areas*. Upon completion of containment seal area repairs, a leakage rate test will be performed per the *Maintenance/Periodic Leakage Rate Tests Acceptance Criteria.*

Surface Finish of Sealing Areas

The surface finish for all sealing regions shall be a 125 micro-inch finish, or better, to maintain package configuration and performance to design criteria. If the surface condition is determined to exceed 125 micro-inch, the surface will be repaired per the requirements of the SAR, *Seal Area Routine Inspection and Repair*.

Impact Limiters

The impact limiters will be inspected for tears or perforations in the stainless-steel sheets, and for the presence of the fire-consumable plastic plugs. Any damage will be repaired prior to further use.

Core Component Container

In the SAR to be submitted, similar to the containment boundary structural testing requirements, it is expected that the CCC inspection requirements will be qualified to be required only when the packaging has undergone repetitive use that may have challenged the original CCC component qualification. Therefore, due to the limited handling and transport of the HUFPs containing the FFTF material, it is anticipated that inspection of the CCC for damage and integrity of the CCC lifting points will not be required. The CCC is not a containment boundary during transportation operations.

Core Component Container-Adapter

The threads of the six (6) CCC-Adapter lid to body attachment holes will be examined for damage. Any damage will be repaired prior to further use.

Thermal Tests

No thermal tests are necessary to ensure continued performance of the HUFP.

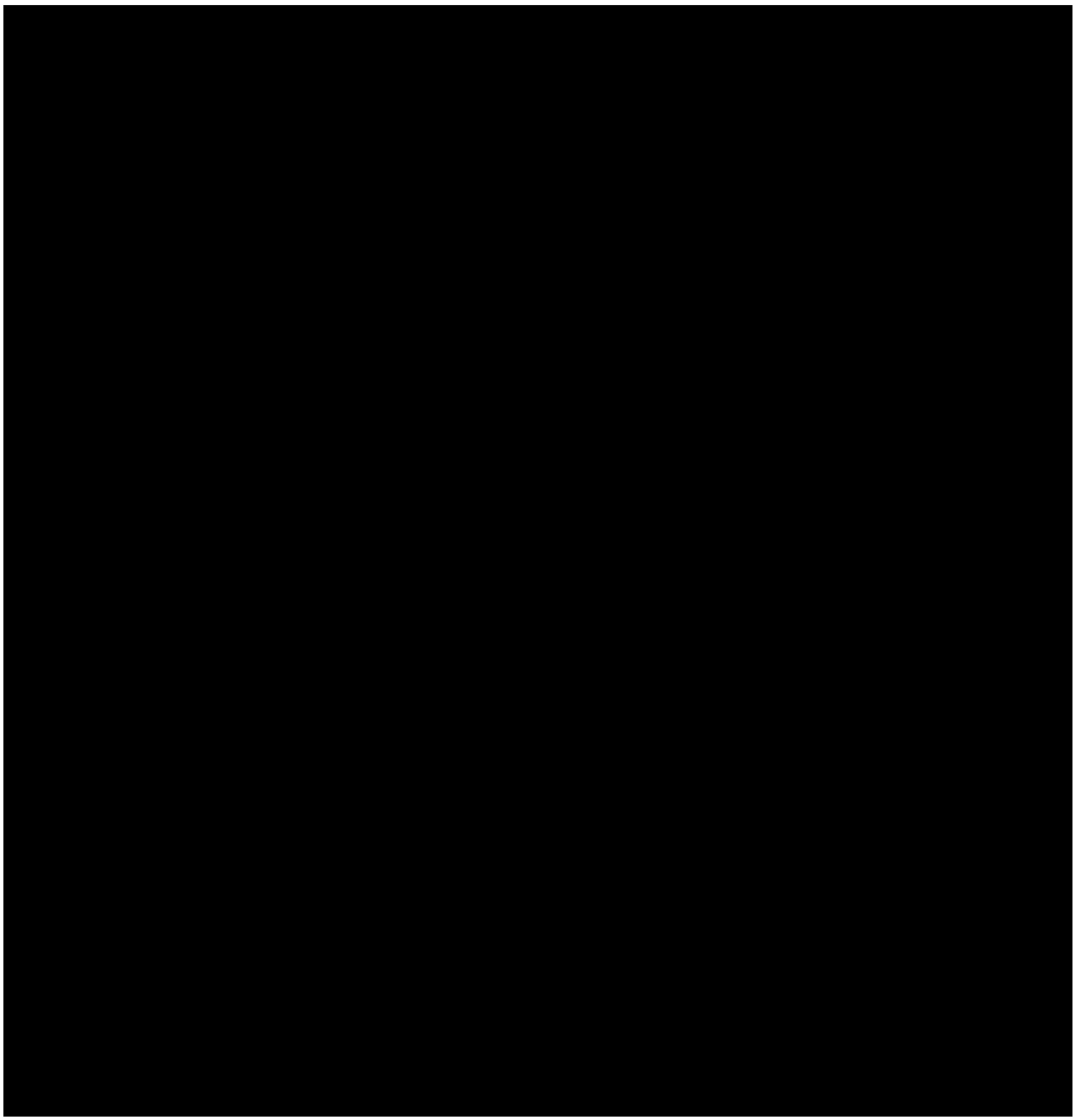
Miscellaneous Tests

No miscellaneous tests are necessary to ensure continued performance of the HUFP.

HUFP Field Inspection/Maintenance Process

The proposed HUFP cask storage and maintenance areas will remain within [redacted] the KAC. The HUFP maintenance will be performed in an area [redacted] depending on the results of the Consolidated Hazards Analysis (CHA) (see Figure 3.4.3). The existing HUFP storage area will be utilized for continued storage of the HUFPs.

Figure 3.4.3 Plan View of K-Area Complex, Elevation 0

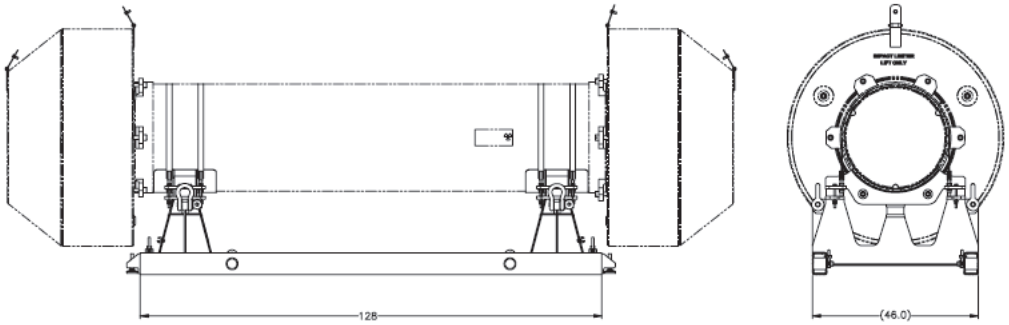


The HUFPs are currently arranged in storage within the [redacted] as depicted in Figure 3.4.4.

Figure 3.4.4 HUFP Storage Configuration

Each individual HUFP is staged on a HUFP Transportation Skid, sometimes referred to as a cradle, supported by steel cribbing at each corner. Figure 3.4.5 depicts a typical HUFP Transportation Skid.

Figure 3.4.5 Typical HUFP Transportation Skid



The proposed inspection and maintenance process is as follows per HUFP: Port-a-Pack hydraulic cylinders will be used to lift the HUFP Transportation Skid off the steel cribbing on which it sits in the [redacted] and then lower the Skid onto Hillman Rollers. The weight of the empty transportation skid is approximately 500 lbs; the loaded transportation skid weight is a maximum of 14,500 lbs. The Skid will be pulled from its storage position to the outside pad of the [redacted] using the pull beam installed inside the [redacted] and necessary clamps and hoists. On the concrete pad [redacted], a mobile crane and appropriate lifting and mechanical equipment will be used to remove the lid end (upper) impact limiter and load the Skid onto an "Upender" or J-Frame device in the maintenance area. In the maintenance area, the package will be inspected for visible damage, including breaching, dents, or cracks. Once the Skid is secured to the Upender device, the Upender is rotated vertically and secured to a vertical support fixture. A lifting sling will be used to remove the Body Assembly Closure Lid. The following components will specifically be inspected for wear or damage in accordance with the SAR: the vent port plug and accompanying seal washer; the seal test port plug and accompanying seal washer; the fill port plug and accompanying seal washer; the closure lid bolts; the impact limiters; and the impact limiters socket head cap screws (SHCS). The closure lid three O-ring seals will be removed and replaced, performing a visual inspection of the sealing surface. It is assumed that a visual inspection of the CCC will not be required. After completion of the O-ring replacement and the various component inspections, the HUFP lid will be reassembled in accordance with the instructions in the SARP. The Upender will be rotated back down to a horizontal position, the Skid containing the HUFP will be removed from the Upender, and a gas pressure rise leakage rate test will be performed on the package to demonstrate containment integrity. Once a successful leak test has been performed, the lid end (upper) impact limiter will be restored using appropriate lifting and mechanical equipment. The Skid will then be moved to a staging table equipped with an air pallet using the mobile crane. A bridge plate will be installed between the staging table and the [redacted] and the HUFP Skid will be floated onto the [redacted]. The HUFP Transportation Skid will be secured to [redacted] using the tie-down rigging. The maintenance and inspection per cask will occur over an approximate [redacted] period, and the tie-down to the [redacted] is expected to take [redacted] per [redacted]. If necessary, dye-penetrant testing of the cask welds can be performed at any point during the maintenance process prior to shipping. Figures 3.4.6

through 3.4.12 include depictions of the typical components to be used for the HUFP movement, maintenance and inspection process. Work Order [redacted], that was used by site Rigging for the receipt and storage of the HUFPs, can be used as information for development of the retrieval and maintenance activity work packages.

Figure 3.4.6 Picture - HUFP Transportation Skid

Figure 3.4.7 Typical Hillman Roller

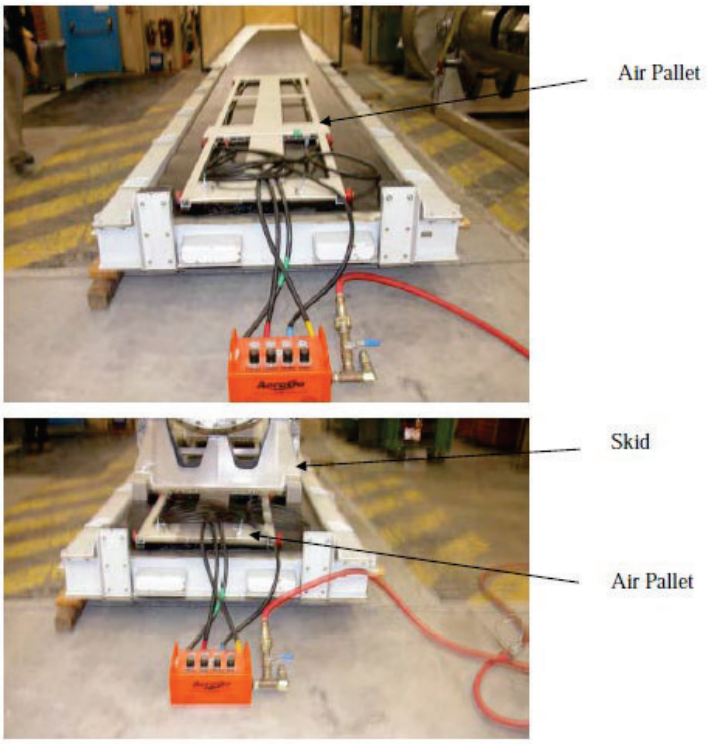
Figure 3.4.8 Typical Port-a-Pac Cylinder

Figure 3.4.9 Removal of Top Impact Limiter

Figure 3.4.10 Lifting of "Upender" or J-Beam Device

Figure 3.4.11 Vertical "Upender" or J-Beam Device

Figure 3.4.12 Typical Air Pallet (With and Without Skid)



Given the weight of the disassembled parts, a mobile crane will be utilized to conduct the heaviest work. While the crane is not in use, it will be stored [redacted].

Only one HUFP will be removed from the [redacted] at a time for the maintenance activities and shipping. Any additional handling that may be required for WIPP WAC certification has not been identified at this time.

The inspection/maintenance process of each HUFP is estimated to take approximately [redacted]. Once the process is completed the HUFP will be loaded onto [redacted] vehicle for shipment to WIPP. This process will be repeated until all [redacted] of the HUFPs have been shipped. As a gross comparison of the savings associated with the direct-discard approach versus disassembly and downblend of the FFTF materials from a transportation perspective alone, this approach will result in [redacted]

[redacted]

Projected Schedule

Activities to support the maintenance and inspection of the HUFPs are projected to commence in [redacted] to support the goal of beginning HUFP shipments from K Area in [redacted]. A breakdown of activities needed to support the HUFP maintenance are projected to occur, depending on the status of other project-associated activities, in the following timeframe.

First/Second Year

- Evaluation and preparation of the legacy equipment to be used to support the maintenance activities.
- Initiation of development of the leak test skid and procedures by SRNL.
- Initiation of procurement/lease arrangement of an air pallet or equivalent to manipulate HUFPs for shipment.

Third/Fourth Year

- Procedure development as part of KAC DSA revision implementation.
- Establish/qualify K Operations/Operations Support/Site Rigging staffing to support HUFP maintenance and shipping.
- Establish/qualify SRNL staffing to support HUFP leak testing.
- [redacted]

Fifth/Sixth Year

- Finalize KAC & WIPP preparation for HUFP readiness
- Initiate/conclude KAC HUFP maintenance and shipping campaign

Projected Cost Estimate

The projected cost estimate to support the HUFP maintenance, inspection and shipping activities is approximately [redacted] The KAC parts of this estimate were reviewed and concurred with by KAC Operations Support. A breakdown of projected costs for Labor and Non-Labor, not including peripheral tasks such as the HUFP SAR preparation and KAC DSA revision that are costed outside of this summary, follow.

Labor

KAC Operations/Engineering

Field Maintenance Procedure/Work Order Dev Support	[redacted]
Training/Qualification	
Legacy Loading Equipment Evaluation & Testing Support	
Field Site Preparation & Equipment Staging	
HUFP Field Maintenance & Loading Support	

[redacted]

KAC RCO/Safeguards & Security/NMC&A
- Security Plan Update/Implementation
- Field Site Preparation & Equipment Staging
- HUFP Field Maintenance & Loading Support

SRNL
- High Pressure Lab Leak Test Skid Preparation
- Leak Test Procedure Development
- HUFP Leak Test Field Implementation
- Field Maintenance Procedure/Work Order Dev Support
- Program/Project Management

Site Rigging
- Legacy Loading Equipment Evaluation & Testing
- Field Work Order/Lift Plan/Permit Development
- Field Site Preparation & Equipment Staging
- HUFP Field Maintenance & Loading Support

Procurement

Non-Labor

Materials for HUFP Maintenance (O-rings, washers, etc.)
Materials for Leak Test Skid
Air Pallet Purchase/Lease
Contingency for Legacy Loading Equipment Repair/Replacement

Additional costs may be incurred by KAC Operations, Engineering and various support groups should the above defined processes be affected by additional KAC DSA controls, additional WIPP controls, or

3.5 KAC DSA Safety Basis Strategy

Current K Area Safety Basis Status

The KAC DSA, and the Technical Safety Requirements (TSR), currently authorize the storage of the HUFPs containing the FFTF materials . Handling, movement, or opening of the HUFPs is not considered within the scope of this authorization. The storage of the HUFPs includes routine inspections and maintenance of the building, and includes primarily regular accountability walkdowns, radiation control surveys, and visual inspections of the exterior of the HUPFs. Replacement of the HUFP O-rings is assumed to be

unnecessary for storage of the FFTF materials based on the butyl O-ring service-life evaluation [redacted] Current surveillance and maintenance activities are assumed to require no intrusive activities (i.e., HUFPs will not be opened). The HUFPs are credited as a design feature with providing confinement and criticality safety as a KAC Safety Basis (SB) Initial Condition and are protected by a Safety Significant (SS) functional classification. No other Safety Class (SC) or SS controls, nor Defense-in-Depth (DID) / Important-to-Safety (ITS) items were deemed warranted for the HUFP storage. Several K Area Safety Management Programs (SMPs) do include administrative features (programmatic elements) that contribute to the protection of the facility worker from the hazards of storage of the HUFPs. Examples of these SMPs include: Conduct of Operations Program, Emergency Response Program, Procedures and Training, Radiation Protection Program, Fire Protection Program, Hazardous Material Inventory Control Program, and Hoisting, Rigging and Scaffolding Program.

SRS is currently developing SB changes needed in [redacted] for the KAC DSA, Rev 16 and the TSR, Rev. 48. The KAC DSA Rev. 16 is projected to be submitted to the Department of Energy – Savannah River (DOE-SR) for approval in [redacted] (i.e., [redacted]). The scope of these changes includes: changes to [redacted] and other miscellaneous changes to support facility and program initiatives.

KAC Safety Basis Revision Scope

Activities needed to manipulate the HUFPs and perform maintenance on the HUFP casks in preparation for shipping as part of an Accelerated Plutonium Removal scope will provide the scope for development of the safety basis strategy (SBS). A preliminary Draft of an SBS for performing the maintenance and shipping of the HUFPs in K-Area is included in Appendix C. The activities to be evaluated and authorized will include the following:

For the [redacted] storage area:

- Removal from and storage of HUFP fully assembled casks on Transportation Skids placed horizontally on steel cribbage.
- Use of hydraulic cylinders, mechanical rollers, and possibly limited motorized vehicles for lifting and moving HUFP casks.

For the [redacted] Pad and HUFP maintenance area:

- Use of cranes, scaffolding and a movable working platform for rotating a HUFP body to a vertical position to perform maintenance for cask certification and returning the cask body to a horizontal position for transportation [redacted] loading.
- Use of rigging and mechanical equipment for removing/installing the top impact limiter;

removing/installing the body closure lid; performing O-ring maintenance; performing low-pressure (31.25 psig) leak-testing; performing dye-penetrant testing as required.

- Personnel performing visual inspection of HUFP components.
- Use of hoists/cranes, motorized vehicles, and air pallets for moving HUFP Transportation Skids.
- Use of equipment for loading HUFPs onto [redacted].

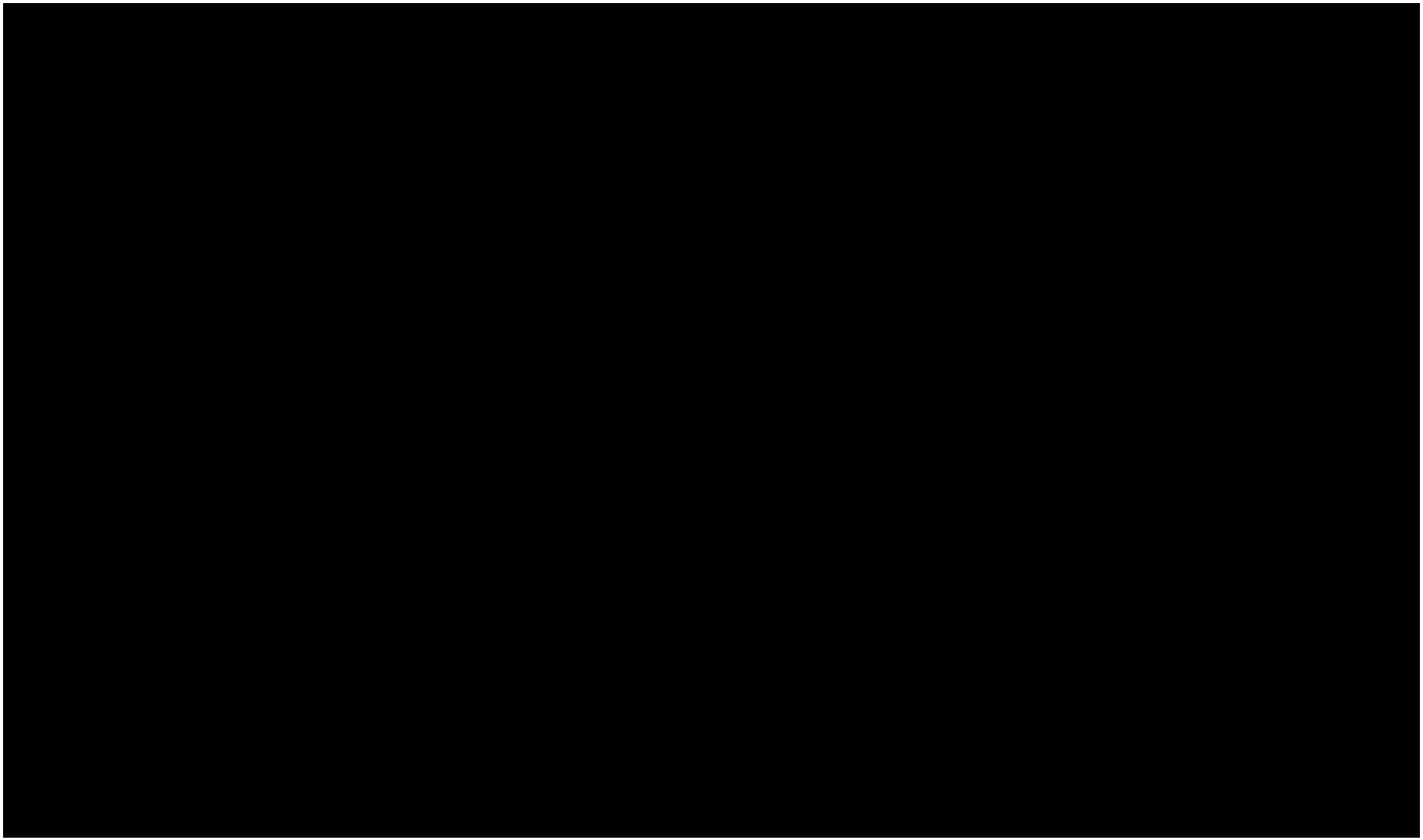
For the development of the DSA and TSR SB changes, supporting documents will need to be completed. The SB supporting documents that are typically needed for SB changes are a CHA, Accident Analysis (AA) calculations, and NCSEs. The above HUFP Maintenance and Shipping scope will require hazard review and evaluation of the potential to impact the existing KAC SB control set. Review of the hazards and the associated control sets will be performed in accordance with the CHA process (SCD-11) with incorporation of the hazard evaluation results into the DSA. The incorporation of the hazard evaluation results into the DSA and TSR revisions may also require changes to the existing control set identified in the CHA. Controls will be selected to protect the public, facility worker and co-located worker. The AA will evaluate the changes to the existing control set identified in the CHA to confirm whether any control set changes necessitate new or revised SS controls for the collocated worker or SC controls. A revision to the existing Fire Scenario Document (FSD) and other Fire Protection Engineering (FPE) documents, new criticality safety analyses and new AAs are also anticipated to support the DSA and TSR revisions. The TSR revision will be developed utilizing the TSR Methodology Manual [redacted] and will reflect the control strategy documented in the DSA revision.

Projected Schedules and Cost Estimate

Development of the DSA Revision [redacted] and associated TSR is projected to commence in [redacted] to support the goal of beginning HUFP shipments from K Area in [redacted]. The following schedule templates reflect projected activities supporting the above schedule as well as a template reflecting an early-start schedule should priority be given to the HUFP maintenance for removal from the state. Figure 3.5.1 reflects a projected schedule for KAC DSA Rev [redacted] with implementation complete by [redacted] Figure 3.5.2 reflects a projected early start schedule to incorporate the HUFP Maintenance and Shipping activities in KAC DSA Rev [redacted] with implementation complete by [redacted] The projected cost estimate to support the DSA/TSR work to be performed by the Nuclear and Criticality Safety Engineering (N&CSE) organization is [redacted] will also be incurred by Operations, Engineering and various support groups to complete the review and implementation of the changes.

Figure 3.5.1 Projected DSA Rev [redacted] Schedule

Figure 3.5.2 Early Start Projected DSA Rev [redacted] Schedule



3.6 K-Area Security Strategy

[redacted]

[redacted]

3.7 KAC NEPA Coverage

Based on a Preliminary review that SRNS has initiated, the existing SPD SEIS (DOE/EIS-0283-S2), ROD and ARODs allow for the direct discard of the FFTF material to WIPP with a secondary option of down blending the materials if direct-discard is not available. The Supplement Analysis (SA) for the Storage of Surplus Pu Materials at SRS (DOE/EIS-0229-SA-4)[32] might also allow for maintenance to be performed upon the cask as part of the storage scope but it will need to be formally reviewed. If the existing NEPA Analyses (SEIS/ROD, SA) cover the limited maintenance scope campaign, SRS may still need to prepare additional NEPA documentation for the proposed activity. If the limited maintenance scope has to be expanded to breech containment of the CCC - the containment vessel of the package, [redacted] a larger NEPA impact may be realized. Study activities identified for SRNS Environmental Compliance (EC) support include:

- K Engineering to draft an Environmental Evaluation Checklist (EEC) for limited scope HUFP maintenance and shipping from K and submit the EEC to SRNS EC for review.

- SRNS EC to review the April 2015 SPD SEIS and Storage SA and determine if a new SA, Interim Action, etc. would be required to handle (for limited maintenance), load [redacted] and ship the HUFPs to WIPP. As an additional part of this existing NEPA coverage evaluation, a limited maintenance-scope (as defined above) and a broader maintenance scope should be considered (i.e., opening of the CCC for internal material package handling.)

- For both a limited scope maintenance approach and a broader maintenance scope approach, EC will define a Preliminary scope of proposed NEPA activities necessary (ex, analyses required, documents to be prepared, authority required for approval), the hours to be applied for each item, and the cost associated with preparation of each item.

- If EC believes a HQ-level document that covers both the WIPP NEPA and K Area NEPA coverage is required as an option, a description will be provided to justify why a common NEPA document is considered required/recommended and a Preliminary scope of proposed activities necessary (ex, analyses required, documents to be prepared, authority required for approval), the hours to be applied for each item, and the cost associated with preparation of each item.

- NNSA is developing a new Environmental Impact Statement for Surplus Plutonium Disposition, that will incorporate decisions from previous NEPA actions and will cover additional analysis of impacts on other sites besides Savannah River (e.g., WIPP and Los Alamos National Laboratory (LANL)). The focus of the SPD SEIS was on SRS activities. [redacted]

Based on the preliminary review noted above, at this phase of the Study, it is assumed that further SRNS EC support is considered Level-of-Effort and will be funded under site EM Program funding.

3.8 WIPP NEPA Coverage

Some type of NEPA evaluation is envisioned for WIPP to authorize the FFTF Direct Discard scope; an EEC performed by WIPP may be all that is required. EM-HQ may need to include coverage of both the SRS and WIPP activities in a common, HQ-approved NEPA document. [redacted] The FFTF Direct Discard Study cost and schedule estimates therefore do not yet include this scope in the projections.

3.9 WIPP PA Evaluation of HUFP Receipt

SNL confirmed with the WIPP inventory analyst at LANL that SRS' Hanford FFTF material was included within the "up to 6 metric ton (MT)" surplus plutonium inventory that was included in the performance assessment calculations for the WIPP Compliance Recertification Application[33] that was delivered to the EPA in March 2019 as supplemented by the Compliance Recertification Application 2019 performance assessment-related appendices in December 2019[34]. The Assessment does not take credit for the containers that the FFTF material is packaged within, but it does continue to screen criticality out for the material based on the post-emplacement criticality analysis for the materials in CCOs. The Compliance Recertification Application process requires a renewal application every five years; therefore, a new application will be initiated in [redacted] for approval by the [redacted] timeframe. Any changes that could be required for the direct discard of the HUFPs to WIPP would need defined for the [redacted] WIPP Compliance Recertification Application process. The WIPP PA currently does not have any waste emplacement models where criticality has screened in as a credible event, and there are no prescriptive requirements for placement, and thus no panel load management controls imposed on WIPP Operations (i.e., random waste placement occurs with no constraints on orientation with other waste configurations in a room based on receipt sequence). [redacted] To be successful, direct discard of the HUFPs

containing the FFTF materials will have to remain consistent with the existing PA approach. [redacted]

3.10 WIPP Criticality Safety Evaluation of HUFP Placement

ORNL completed development of a scope-of-work and estimate in January 2020 to perform an analysis that will evaluate the post-emplacement criticality of the HUFPs with FFTF material content at WIPP. The analysis will consider the initial conditions of disposal as well as potential conditions that may exist throughout the disposal analysis period (e.g., initial emplacement, room closure and package compaction, and long-term package degradation). The expected duration for the analysis work scope is [redacted] with a funding request of [redacted]. The initial assumption is that the HUFP with impact limiters removed will be emplaced among other packages (i.e., "random" placement) without special consideration. For the initial placement geometry, the effect of emplacement configuration, package spacing and the sensitivity to other packages and materials in the panel will apply. Brine intrusion throughout the storage period will apply. It is assumed room closure compaction will result in the HUFP packages being pushed together as well as being deformed. Degraded geometry calculations will include complete corrosion of the HUFP, potential changes in the DFA separation, and complete corrosion of the DFA and cladding. [redacted] Appendix D contains the full detail of the draft scope of work prepared by ORNL for the criticality safety evaluation of the HUFPs at WIPP.

3.11 WIPP Safeguards/WAC Negotiations

[redacted] A safeguards strategy for WIPP for receipt, handling and emplacement activities will be required. DOE-EM expects to consult with EM 3.114 and DOE Safeguards, Security and Emergency Services (SS&ES) to engage the appropriate authority for directing that a WIPP Safeguards Strategy scope and estimate be developed, potentially by SRNS SS&ES. An additional review of the WIPP Safeguards Strategy may be required by the [redacted] as well. The FFTF Direct Discard Study cost and schedule estimates therefore do not yet include this scope in the projections.

Likewise, negotiations remain to be performed regarding explicit Contact Handled TRU (CH-TRU) requirements for WIPP certification [redacted] As part of the AKSR development process, the Waste Matrix Code and Group will be defined (ex., S5000 Debris Waste); the TRUPACT-II Content Codes (TRUCON) to be assigned to the waste will be defined; the material will be evaluated for reduced headspace sampling based on the fuel oxide and pellets having undergone a high-temperature thermal process that would have driven off volatile organic compounds; [redacted]

[redacted] TC organics are not expected to be present within the MOX materials; the materials as waste are to be evaluated against the 40 Code of Federal Regulations (CFR) 261 subpart definitions of ignitability, reactivity, corrosivity, and listed hazardous waste; the materials as waste do not contain any chemicals regulated under the Toxic Substances Control Act; [redacted] The CBFO authorizes the Los Alamos National Security-Carlsbad Operation, Repository Science and Operations (RSO) Program, Difficult Waste Team (DWT) to provide their technical expertise on TRU waste to the generator sites to solve technical issues dealing with TRU waste recovery and remediation, packaging and storage, characterization techniques, acceptable knowledge, transportation, and efficient and compliant disposal of TRU waste. The DWT could be consulted in development of a strategy for certification of the Hanford Unirradiated Legacy Fuel Assemblies, Fuel Pins, and Pin Material waste stream from SRS. Funding will need to be provided to the CBFO for the waste stream support by CCP and/or the DWT; the amount of funding needed to support this activity will need to be determined based on negotiations outside of this study. SRNS TRU Waste Program costs are expected to be covered by the site-level TRU Waste Program funding.

3.12 Total SRS Scope Cost Roll-Up

The estimates included in this Study are ROM budget placeholders. As ROM estimates, the fidelity is most accurate for the near-term portion of the activities. Thus, if the activities are authorized as a project, it is expected that estimates would again be refined, and resource loaded to better reflect the next steps. Funding is assumed to be available in [redacted] to initiate the project.

Table 3.12.1 Scoping Study Preliminary Cost Estimate Summary

	Preliminary Cost Estimate Range	
Summary Task Element	**Low End**	**High End**
HUFP NRC-Format SARP	[redacted]	[redacted]
HUFP Maintenance/Shipment	[redacted]	[redacted]
KAC Safety Basis Revision	[redacted]	[redacted]
ORNL WIPP Emplacement Criticality Safety Evaluation	[redacted]	[redacted]
SRNS Support for NEPA Evaluation	Level-of-Effort	TBD if broader invasive HUFP maintenance is required
SRNL Support for Project Management (including PVD/DD resolution)	[redacted]	
Total Based on Study	[redacted]	[redacted]

[redacted]

Additional Costs to Be Evaluated as Interface with CBFO and WIPP M&O:	TBD
Safeguards Strategy for WIPP Emplacement of HUFPs	
WIPP Operations Strategy for emplacement of HUFP cask without impact limiters	
[redacted] evaluation for HUFP transport and emplacement at WIPP	
WIPP Environmental Evaluation Checklist (EEC) confirming NEPA Coverage	
[redacted]	
Alternate Certification Strategy with CCP	

The projected rollup profile for the low-end and high-end estimates are shown graphically in Figures 3.12.1 and 3.12.2.

Figure 3.12.1 Projected Low End Cost Profile

[redacted]

Figure 3.12.2 Projected High End Cost Profile

[redacted]

[redacted]

3.13 Total SRS Scope Proposed Schedule

Figure 3.13.1 SRS Proposed Schedule For Direct Discard of HUFP FFTF Materials

4.0 RISKS/OPPORTUNITIES

Until the scope of direct discard of the FFTF materials in the HUFPs can be negotiated with WIPP Operations and the CBFO, this scope has been recognized as presenting certain levels of risk to the DOE. The following is a summary of known risks (identified with the letter R) and opportunities (identified with the letters Op) associated with the direct discard of the HUFPs containing the FFTF materials and potential program and policy constraints that could limit the success of this approach.

R1. The NRC may require additional testing of the HUFP as part of the package SARP certification process, impacting the proposed Project schedule.

R2. WIPP may not be able to accommodate the required controls for receipt of the HUFPs [redacted]

R3. [redacted]

R4. WIPP may not be able to accommodate [redacted] to support removal of the HUFP impact limiters for handling and placement of the HUFP body in the room panels. (The HUFP length with impact limiters installed is larger than the WIPP elevator platform can accommodate. The impact limiters will need removed for the remainder of the cask to be lowered to the room panels.)

R5. Additional DOE/NNSA, SRS, or WIPP NEPA analyses, review and approvals may impact the proposed Project schedule.

R6. A WIPP Operations Strategy to receive, handle and emplace the HUFP components may require a longer-lead duration, impacting the proposed Project schedule.

R7. [redacted]

R8. Other Program and Project activities in the KAC could constrain resources and personnel availability, impacting the proposed schedule.

Op1. [redacted] may define a programmatic use for some or all of the Hanford FFTF assemblies, pins or materials.

Op2. [redacted]

5.0 CONCLUSION

In order to support an Accelerated Pu Disposition effort of legacy surplus materials at SRS, SRS must disposition approximately 700 kg of surplus plutonium contained in Hanford unirradiated legacy fuel assemblies, pins, and pin materials, i.e., most as high quality surplus plutonium-bearing mixed oxide material originally destined for fabrication into fuel components; archive materials returned to Hanford as part of the Plutonium Recycle Program, Mutual Defense Agreements, and Agreements for Cooperation with other countries; and materials from reactor fuel research, development and fabrication activities conducted at Hanford. The SPD SEIS (DOE/EIS-0283-S2), ROD, and ARODs allow for the direct discard of the materials to WIPP with a secondary option of down blending the materials if direct discard is not available. To expedite the material disposition, efficiently expend resources for the disposition, and to reduce overall personnel occupational exposure associated with the disposition, this Study provides an unclassified evaluation of the SRS scope of work required to perform disposition of the surplus, legacy Hanford FFTF materials at WIPP without SRS processing or repackaging of the material and with limited existing storage container manipulation, and provides estimates and schedules for subsequent SRS effort. The Study team did not interface with and engage the technical, regulatory and operating organizations at WIPP; a related evaluation by these individuals will be required in order to fully detail the cost and schedule for direct discard of the legacy Hanford FFTF materials at WIPP.

The following provides a brief summary of the conclusions reached in the areas evaluated.

- A PVD has been prepared by SRNL [redacted] The PVD is used to determine if there is other programmatic interest or need for the FFTF material prior to disposition. Concurrence with the PVD [redacted] is pending at this time while they determine if their programs would like to assume ownership of any of the materials for potential future [redacted] application.

- A preliminary Defense Determination documentation package has been prepared for the potential waste stream described as SRS' "Hanford Unirradiated Legacy Fuel Assemblies, Pins and Pin Material". The documentation substantiates that the material within the HUFP packages, that would be recategorized as waste, was related to "atomic energy defense activities". The HUFP

Defense Determination activities are projected to continue in [redacted] and [redacted], with final negotiation with CBFO and approval of the Defense Determination package secured in [redacted]. The projected cost estimate of SRNL activities to support the resolution of the Defense Determination documentation are included within the [redacted] defined for technical support and project management as part of the Maintenance Strategy cost estimate. SRNS TRU Waste Program costs are expected to be covered by the site-level TRU Waste Program funding.

- SRNL Packaging & Systems Technology developed a preliminary HUFP licensing and certification estimate to prepare a new, NRC-format SAR to be submitted to the NRC based on the EM-licensed HUFP SARP. The estimate involves approximately [redacted] of scope and would require [redacted] for development of the SAR, pre-submittal meetings, travel, response to regulatory questions and other applicant actions required to obtain an NRC certification. The estimate assumes no new cask testing is required but does include some funding for limited analyses updates. This preliminary estimate does not include MR or additional contingency. Coupled to the SRNL costs, the NRC-associated review costs will range from approximately [redacted] based on a [redacted] review cycle.

- Per the anticipated NRC-format HUFP Safety Analysis Report, annual maintenance and periodic leakage rate tests will have to be performed for the HUFPs to be shipped [redacted]. The HUFP maintenance and shipping activities are projected to commence in [redacted], occurring one HUFP at a time, and staggering the package evolutions to ensure emplacement distribution as desired by WIPP. The projected cost estimate to support the HUFP maintenance, inspection and shipping activities is approximately [redacted]. Additional costs may be incurred by KAC Operations, Engineering and various support groups should the expected maintenance, inspection and shipping activities be affected by additional KAC DSA controls, additional WIPP controls, or the need to perform the maintenance on the HUFP containers within [redacted] Should the maintenance need to be performed [redacted], additional costs of [redacted] would be required [redacted]

- To accommodate the maintenance and shipping activities associated with the HUFPs in K Area, a revision of the K Area SB will be required. For the development of these SB changes, supporting documents such as a CHA, AA, various calculations, and an NCSE will be required, with revisions also needed to the FSD and FPE. Development of the DSA and TSR revisions could commence in [redacted] to support the goal of beginning HUFP shipments from K Area in [redacted] To accelerate this timeline, these safety basis changes could be coupled to other DSA Rev. [redacted] changes or implemented ahead of the projected SPD DSA Rev. [redacted] scope. The projected SRNS N&CSE costs for preparation of the SB and supporting documentation are anticipated to be approximately [redacted]. An additional [redacted] will also be incurred by Operations, Engineering and various support groups to complete the review and implementation of the changes.

- [redacted]

[redacted]

- Based on a Preliminary NEPA review that SRNS has initiated, the existing SPD SEIS (DOE/EIS-0283-S2), ROD and ARODs allow for the direct discard of the FFTF material to WIPP with a secondary option of down blending the materials if direct-discard is not available. The SA for the Storage of Surplus Pu Materials at SRS (DOE/EIS-0229-SA-4) might also allow for maintenance to be performed upon the cask as part of the storage scope but it will need to be formally reviewed. Based on the preliminary review noted above, at this phase of the Study, it is assumed that further SRNS EC support is considered Level-of-Effort and will be funded under site EM Program funding.
- Some type of NEPA evaluation is envisioned for WIPP to authorize the FFTF Direct Discard scope; an EEC performed by WIPP may be all that is required. EM-HQ may need to include coverage of both the SRS and WIPP activities in a common, HQ-approved NEPA document. [redacted] The FFTF Direct Discard Study cost and schedule estimates therefore do not yet include this scope in the projections.
- SNL confirmed with the WIPP inventory analyst at LANL that SRS' Hanford FFTF material was included within the "up to 6MT" surplus plutonium inventory that was included in the performance assessment calculations for the WIPP Compliance Recertification Application that was delivered to the EPA in March 2019 as supplemented by the Compliance Recertification Application 2019 performance assessment-related appendices in December 2019. To be successful, direct discard of the HUFPs containing the FFTF materials will have to remain consistent with the existing PA approach.
- ORNL completed development of a scope-of-work and estimate in January 2020 to perform an analysis that will evaluate the post-emplacement criticality of the HUFPs with FFTF material content at WIPP. The analysis will consider the initial conditions of disposal as well as potential conditions that may exist throughout the disposal analysis period (e.g., initial emplacement, room closure and package compaction, and long-term package degradation). The expected duration for the analysis work scope is [redacted] with a funding request of [redacted]
- A safeguards strategy for WIPP for HUFP receipt, handling and emplacement activities will be required. DOE-EM expects to consult with EM 3.114 and DOE SS&ES to engage the appropriate authority for directing that a WIPP Safeguards Strategy scope and estimate be developed, potentially by SRNS SS&ES. An additional review of the WIPP Safeguards Strategy may be required by the [redacted] as well. The FFTF Direct Discard Study cost and schedule estimates do not yet include this scope in the projections pending discussions with WIPP CBFO and WIPP Operations.
- Negotiations remain to be performed regarding explicit CH-TRU requirements for WIPP certification [redacted] Characterization and certification elements

will be negotiated during development of the AKSR. [redacted] An Alternate Certification Strategy may be required to address characterization methods normally employed. Funding will need to be provided to the CBFO for the waste stream support by CCP and/or the DWT; the amount of funding needed to support this activity will need to be determined based on negotiations outside of this Study. SRNS TRU Waste Program costs are expected to be covered by the site-level TRU Waste Program funding.

- Funding is assumed to be available in [redacted] to initiate the project. For the SRS scope defined in the Study, the total low-end estimate is ~ [redacted], with a high-end estimate of [redacted] Additional costs will be incurred by DOE in the amount of funding needed to support CCP in the development of the waste stream AKSR, WIPP Security Strategy, WIPP Operations preparation for the HUFP receipt and handling, and possibly additional costs not yet envisioned at WIPP.
- The Preliminary schedule proposed in this Study is predicated on a decision by EM to proceed with a project for direct discard of the HUFPs to WIPP by the second quarter of [redacted]. Assuming the necessary funding is also available, and negotiations with WIPP proceed favorably, the various tasks identified in the Study and above would proceed beginning in [redacted] and conclude in early [redacted]. KAC would begin shipping the HUFPs to WIPP in [redacted] and conclude the shipping campaign in [redacted], thereby accelerating the removal of the materials from the state while avoiding additional expense by the government to prepare the FFTF materials for down blend for disposal.

During the Study report review process, the following additional information related to the WIPP regulatory licensing process and duration was requested to be added to the report.

- For the WIPP facility, the New Mexico Environment Department (NMED) regulates hazardous and mixed waste; the EPA regulates TRU waste in accordance with RCRA. At five year intervals, WIPP submits a recertification package to the EPA, which includes operational, scientific, geotechnical and environmental monitoring information to demonstrate that WIPP met criteria for the previous five years, and that WIPP's underground disposal system will continue to safely contain radionuclides for a 10,000-year regulatory period. Every ten years NWP and the CBFO submit a Hazardous Waste Facility Permit (HWFP) recertification application to the NMED, and every five years they submit a Compliance Recertification Application (CRA) package to the EPA. The last HWFP recertification application with the NMED was submitted in March 2020 (current permit expires 12/2020.) The last CRA submittal with the EPA was in 2019. The next submittal to the EPA will be in 2024. [redacted]

  As part of the WIPP NMED Permit RCRA Application, a Waste Analysis Plan (WAP) establishes the waste characterization requirements for the DOE waste generators. The WAP contains elements such as characterization methods (visual examination, AK sufficiency, radiography, sampling and assay), Quality Assurance (QA) requirements, etc. If a generator

wants to make a significant change that will affect the analyses supporting the permit from the NMED, such as changing from a waste drum to a HUFP cask, it will require an HWFP Permit Modification Request (PMR) that is submitted though the NMED as a Class 3 Modification. A Permit Change Request (PCR) or a Permit Change Notice (PCN) to the EPA is used primarily to denote a change in something that is already in the WIPP baseline permit. PCRs and PCNs are not to be used to request a significant change, and only result in a baseline inspection for approval. A PMR is known as a Class 3 Mod and must be approved through NMED. A Class 3 Mod can cost from [redacted] and may take [redacted] but has no typical approval cycle duration. Therefore, the WIPP regulatory approval process for direct disposal of the HUFPs will require completion of supporting analyses, submittal of the PMR and approval by NMED, and then submittal of a PCR and approval by the EPA.

It is anticipated that the sponsor will review the information presented in this report and will provide funding and authorization to initiate the negotiations with the CBFO and WIPP Operations and to continue further scope efforts in [redacted]. The ROM estimates and rollup cost estimate summary will also serve as an aid in development of [redacted] and outyear budget planning.

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Programmatic Value Determination Request

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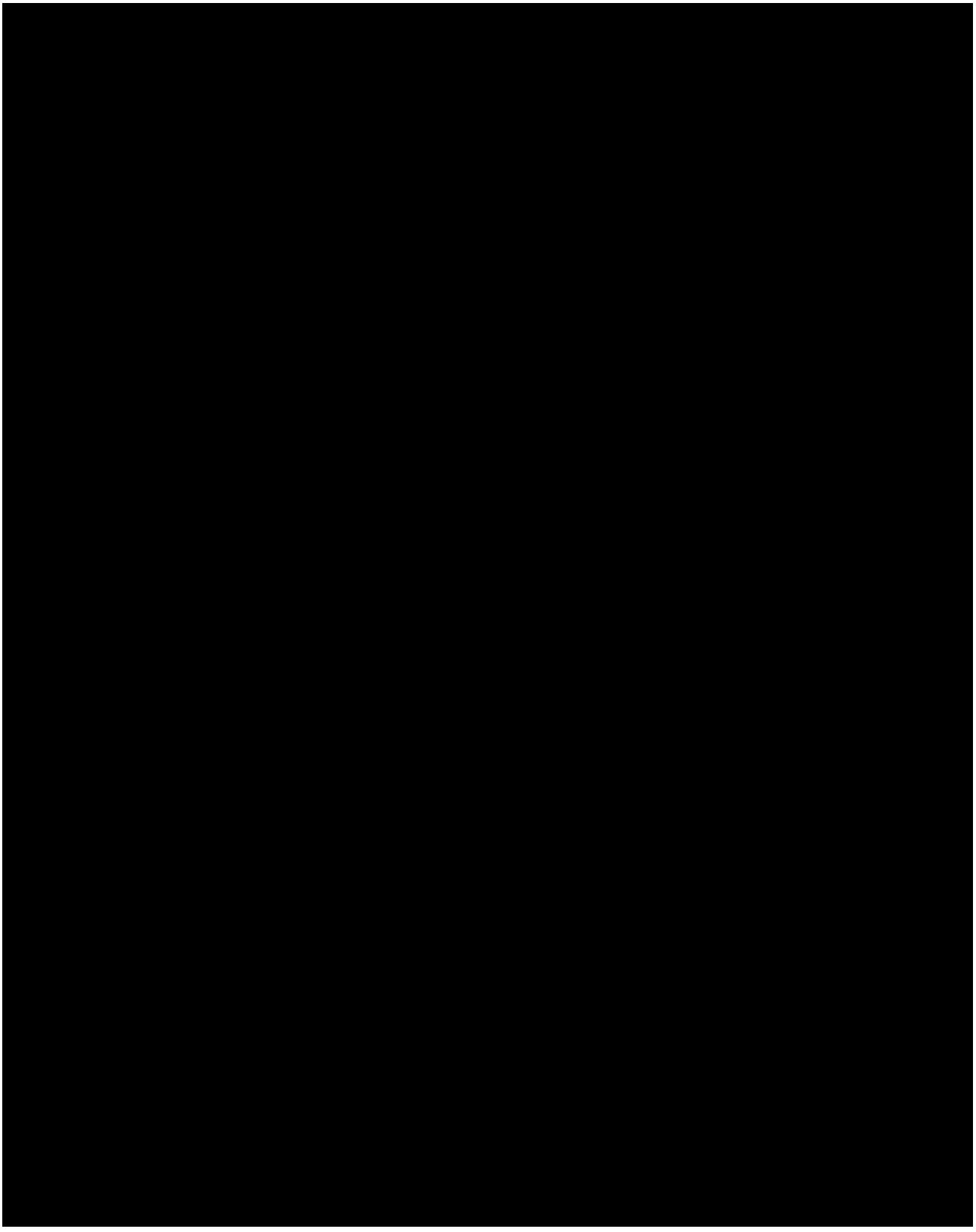

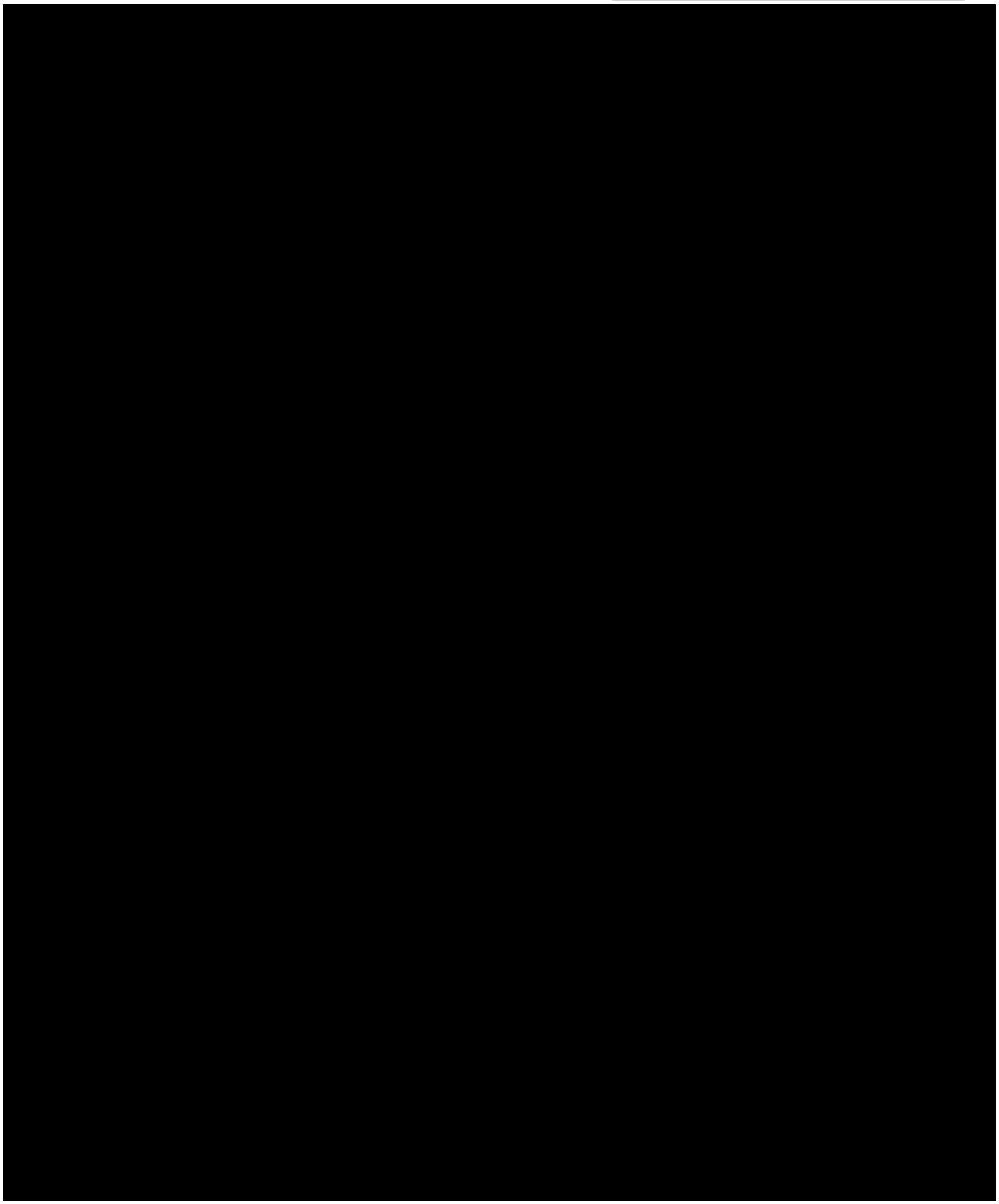

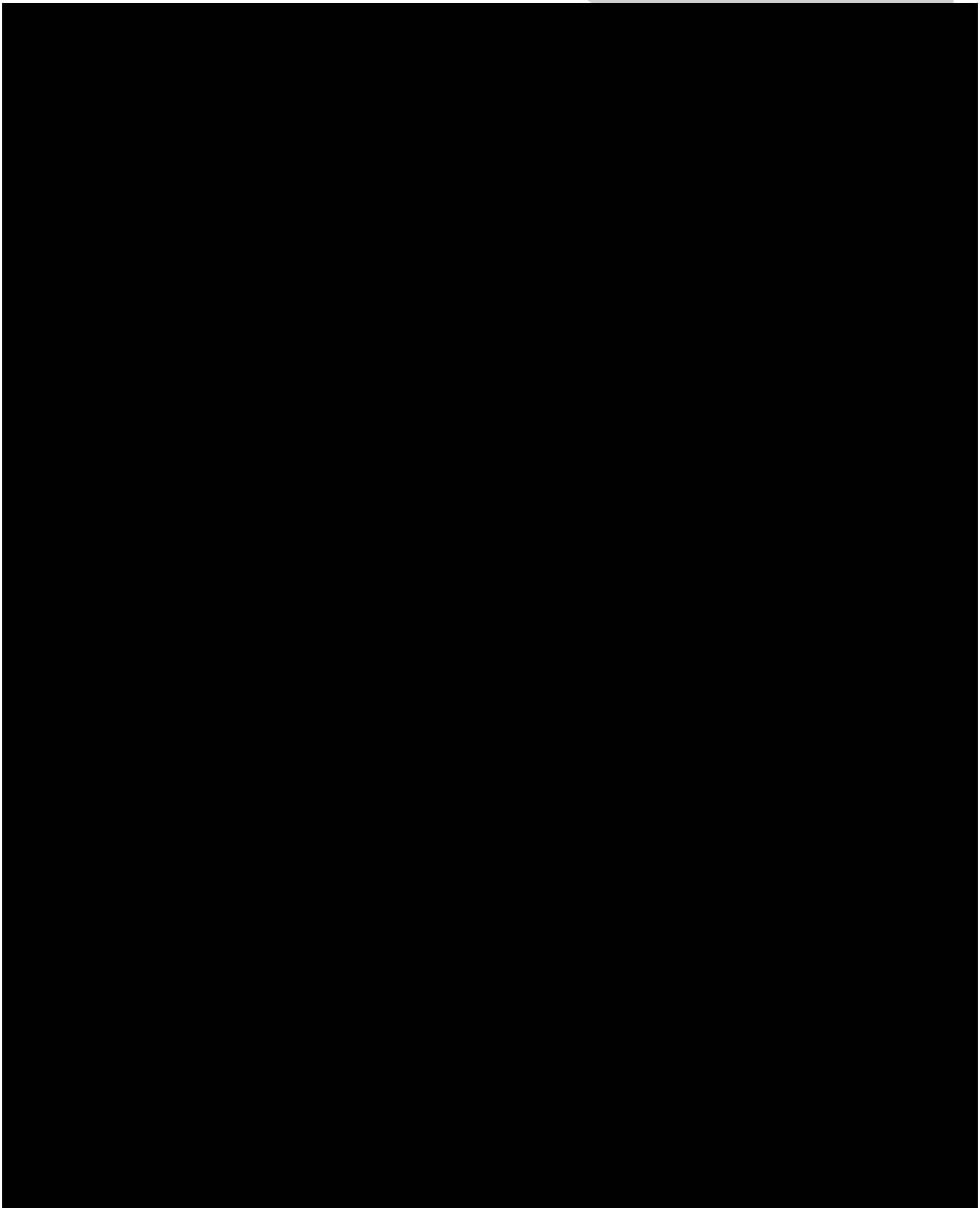

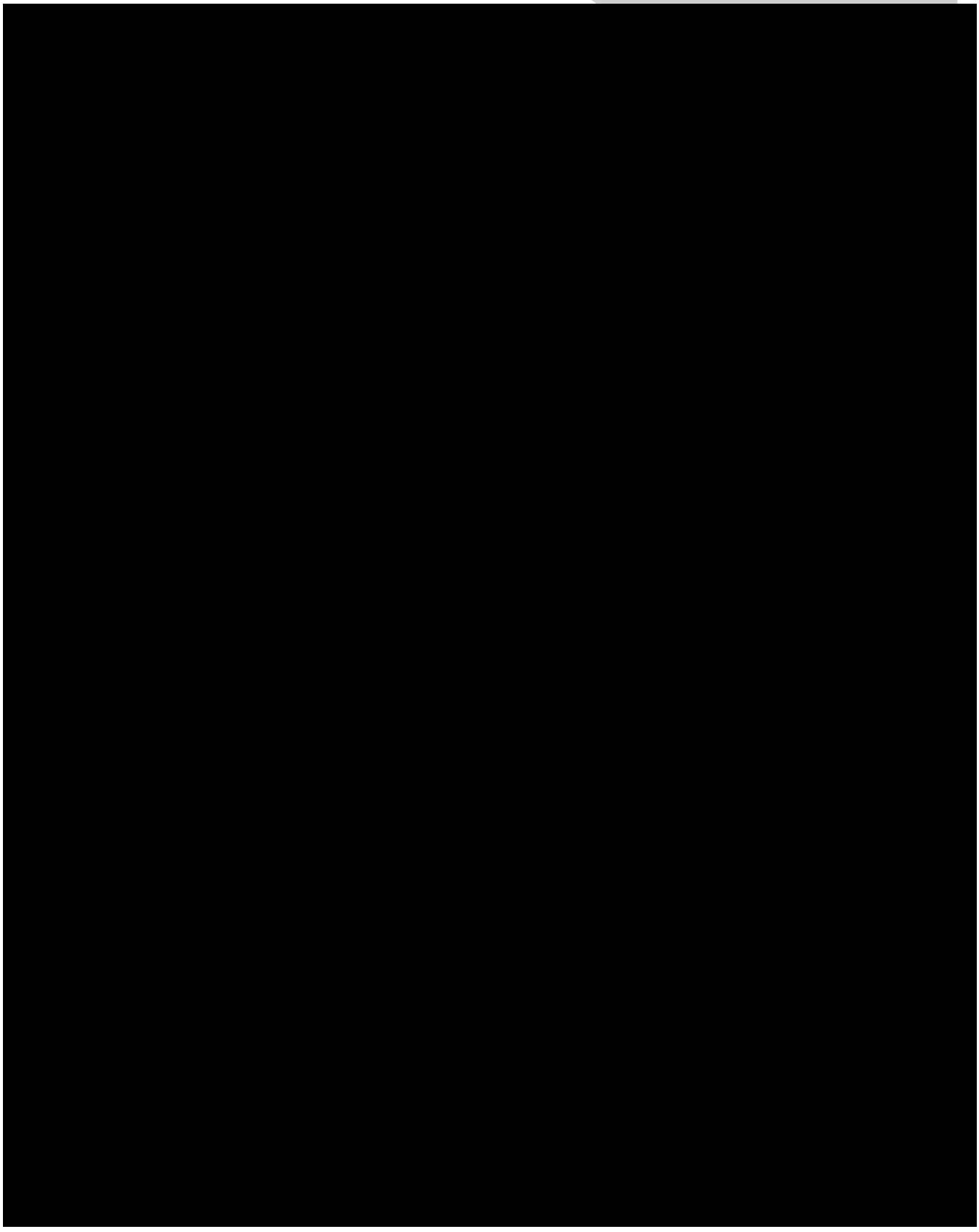

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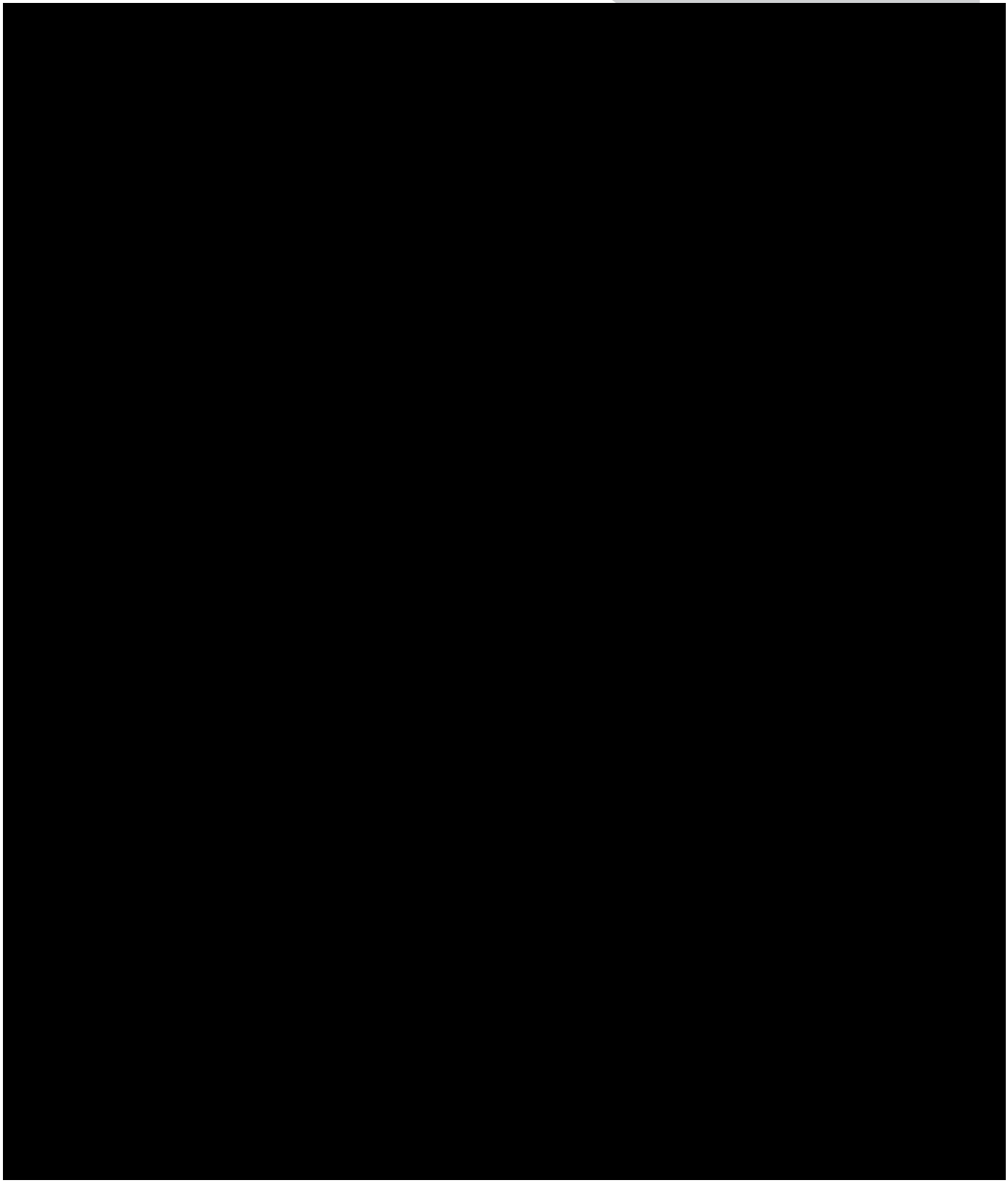

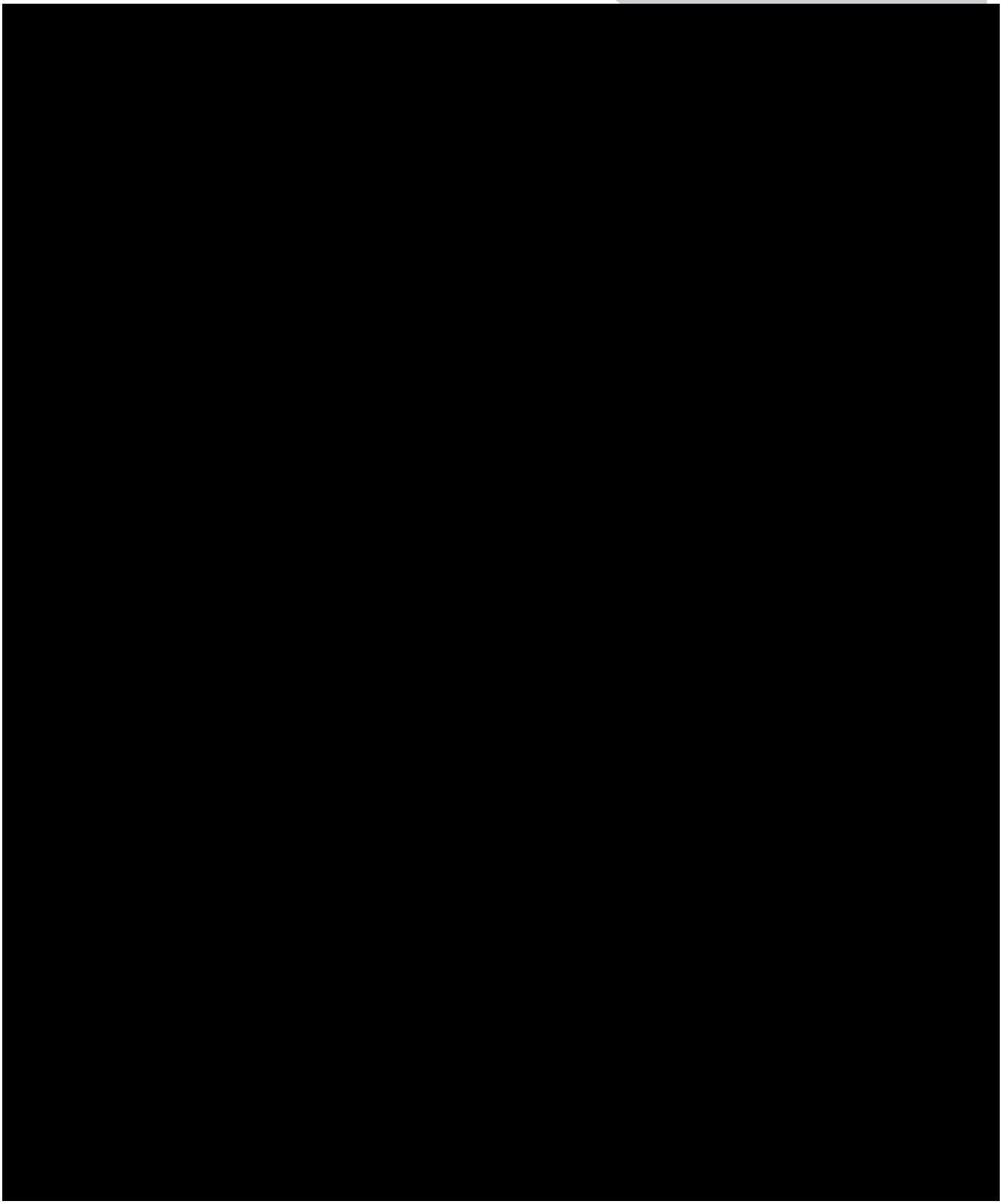

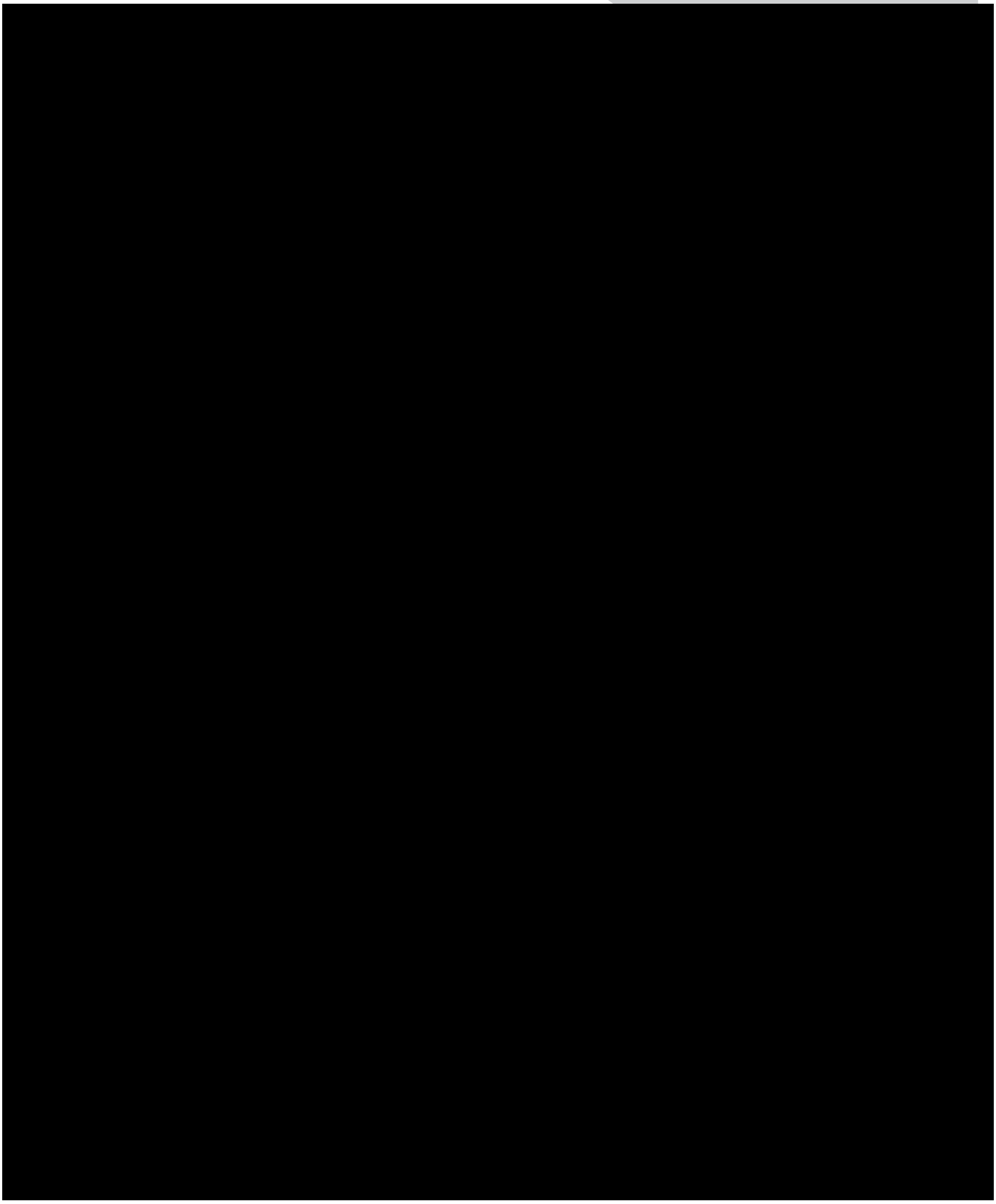

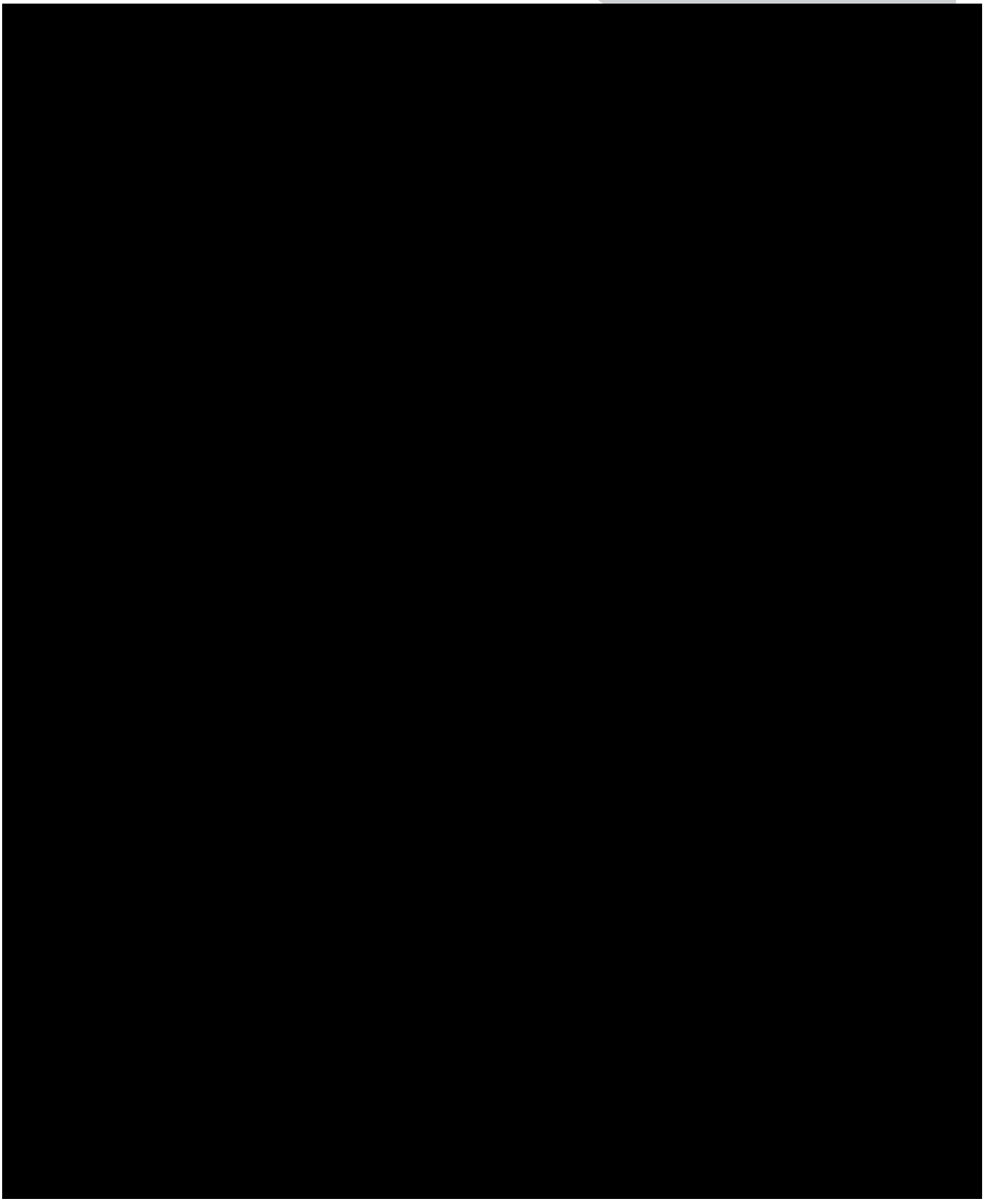

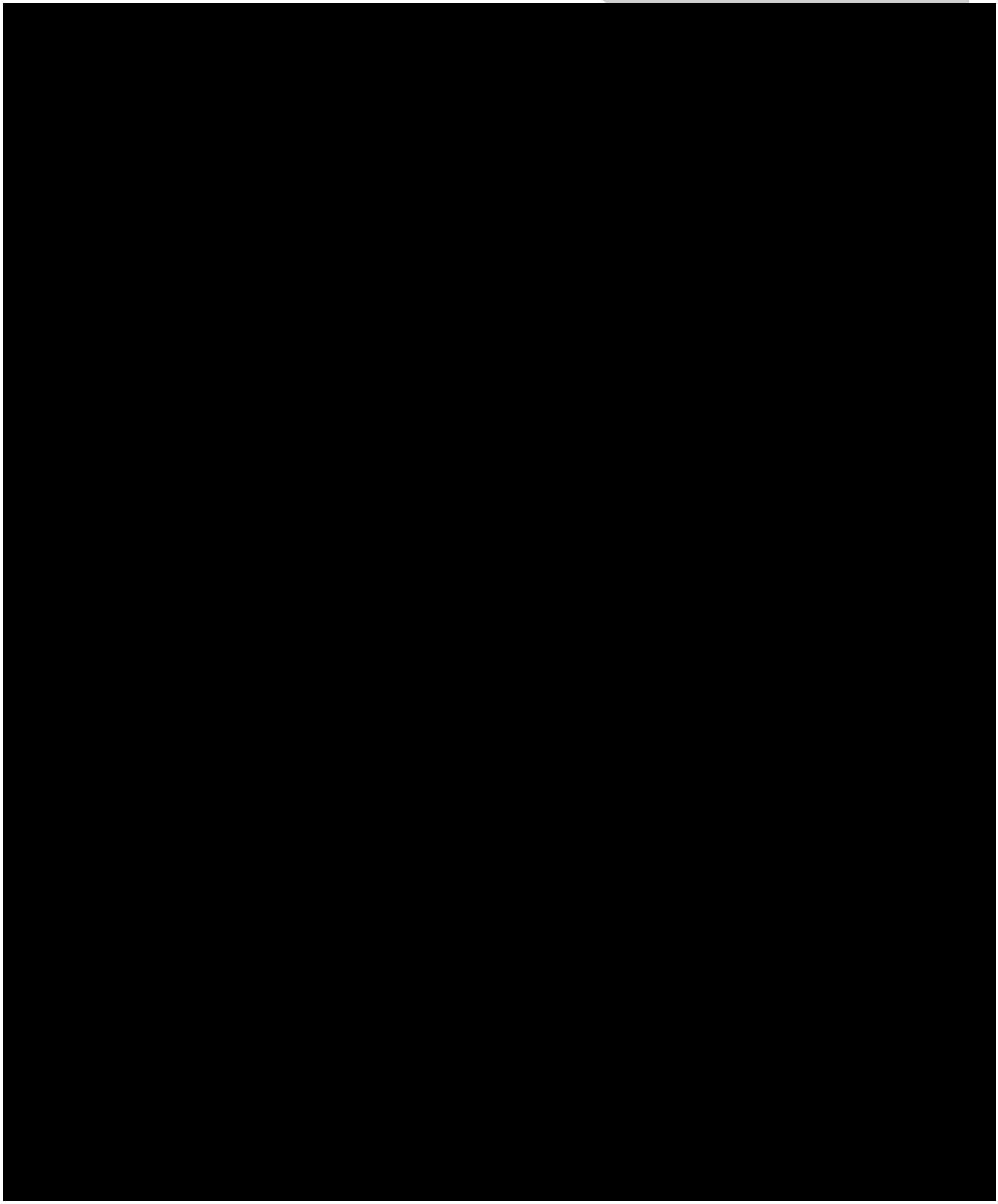

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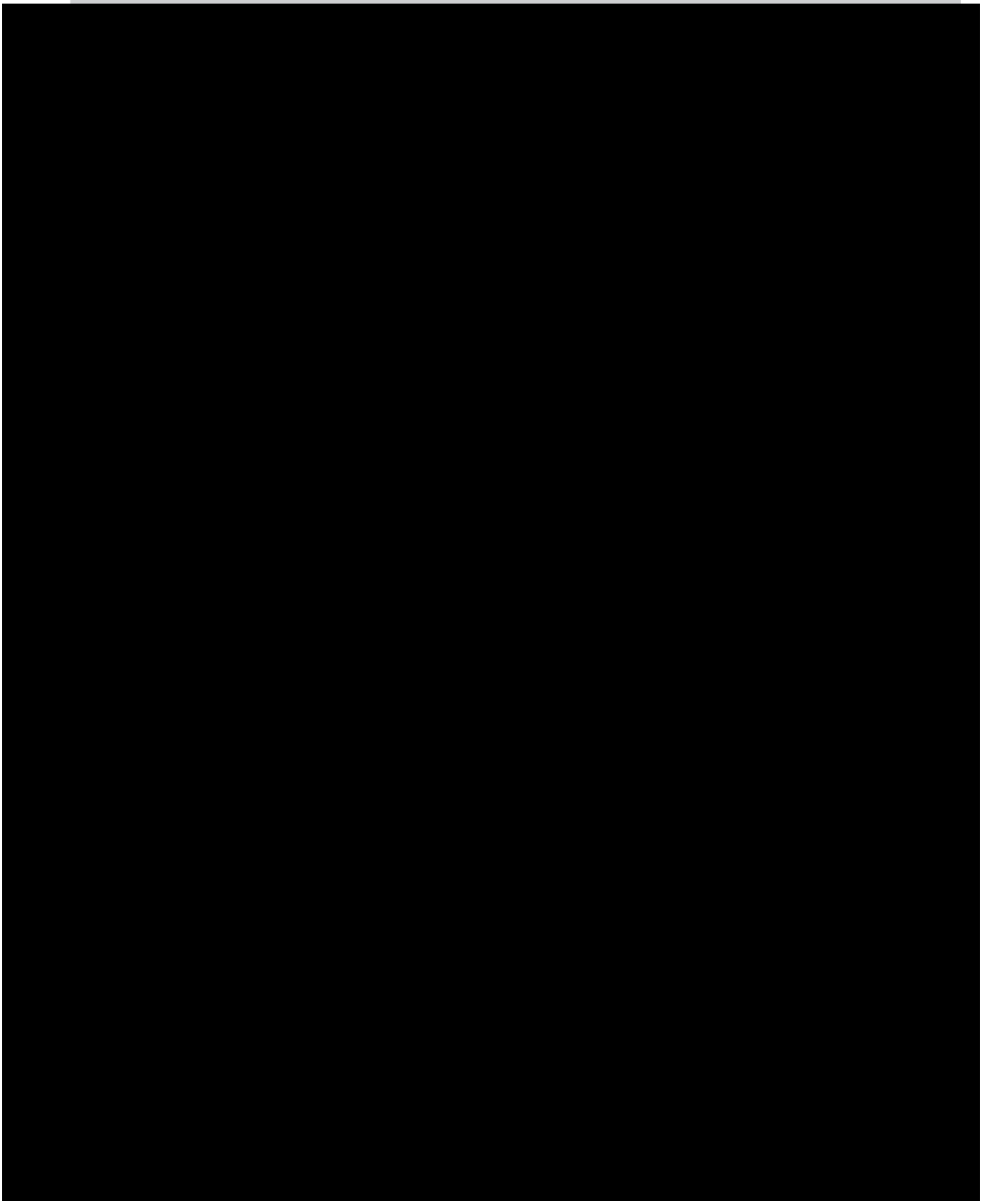

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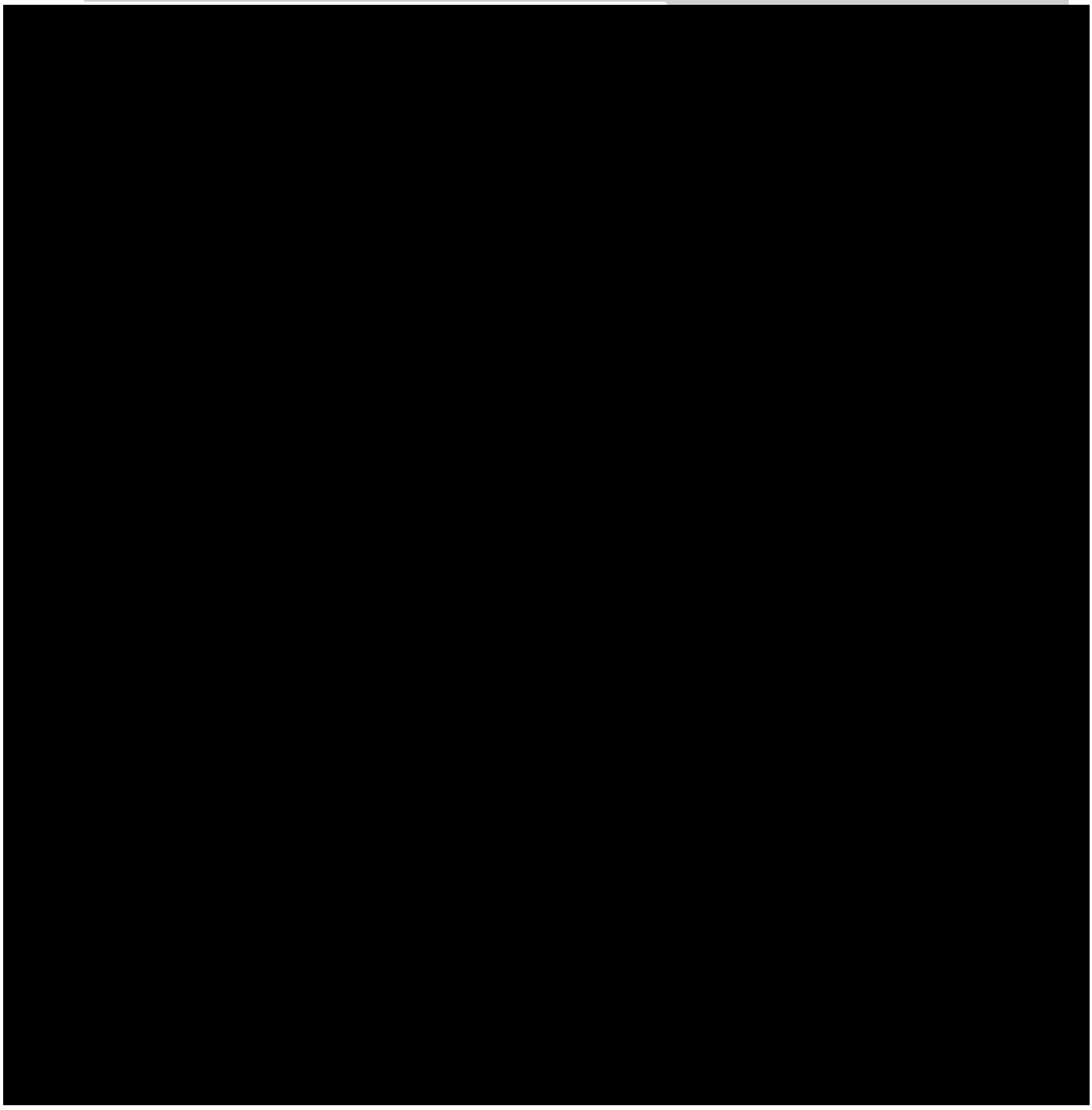

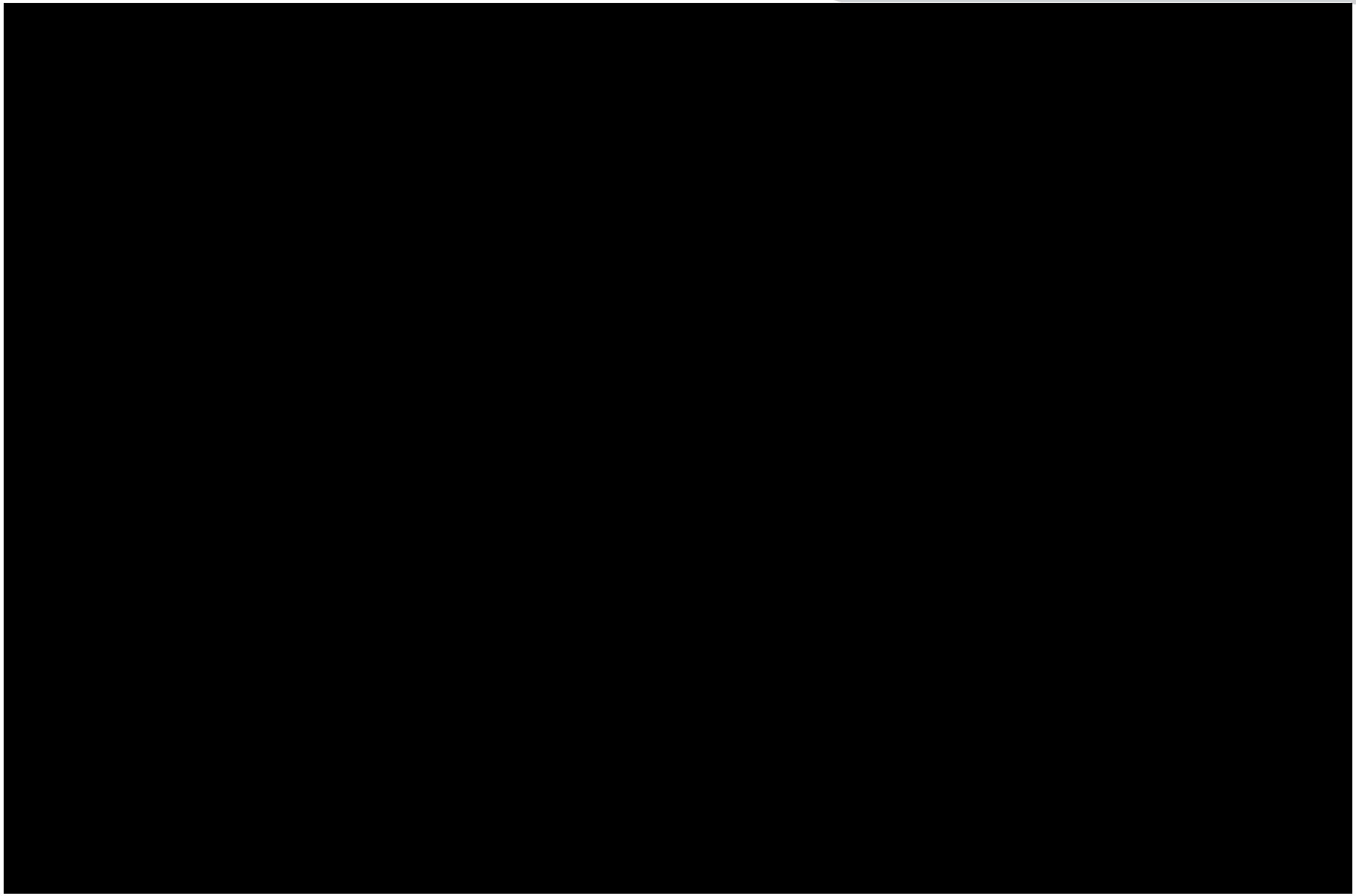

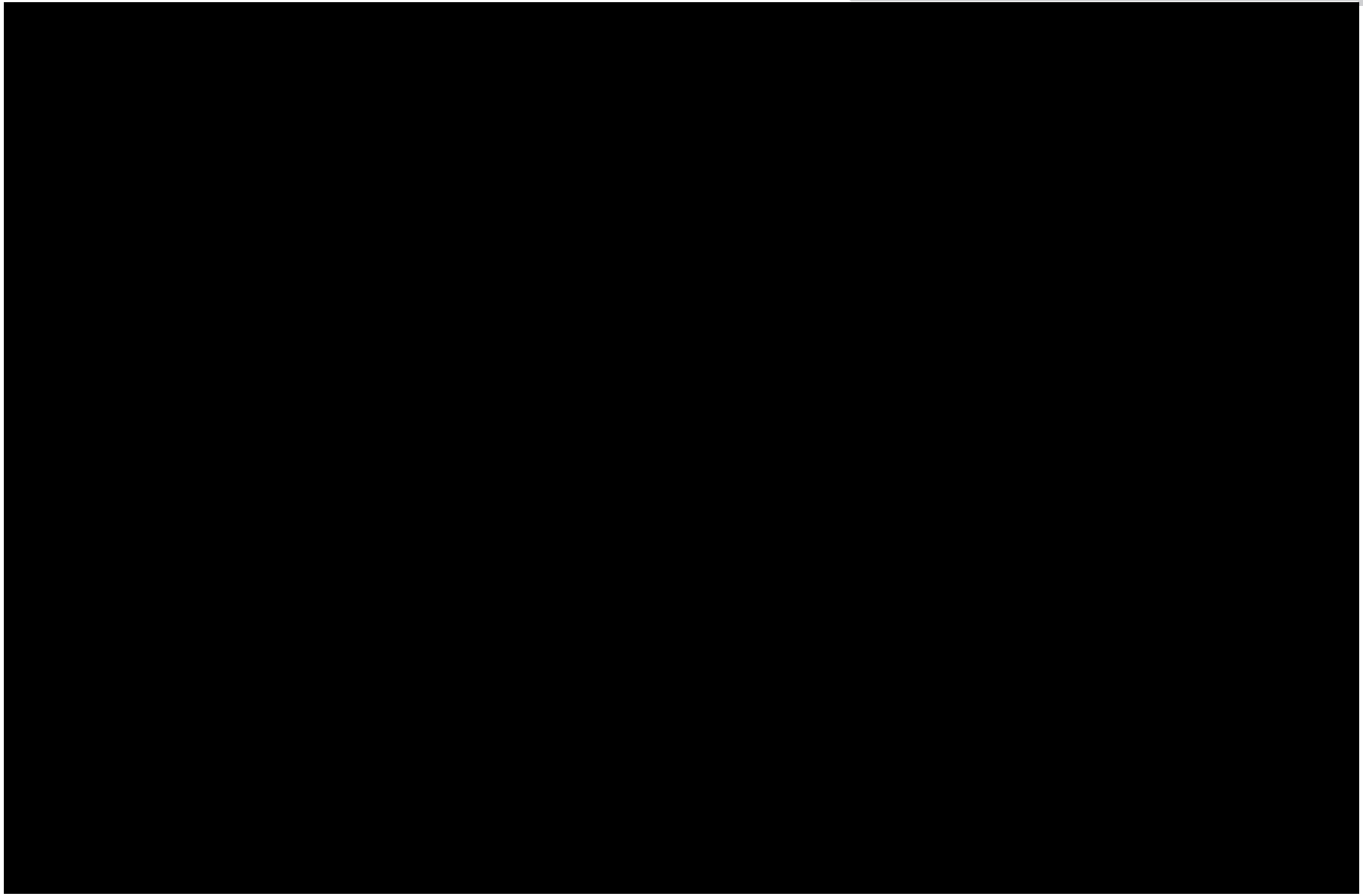

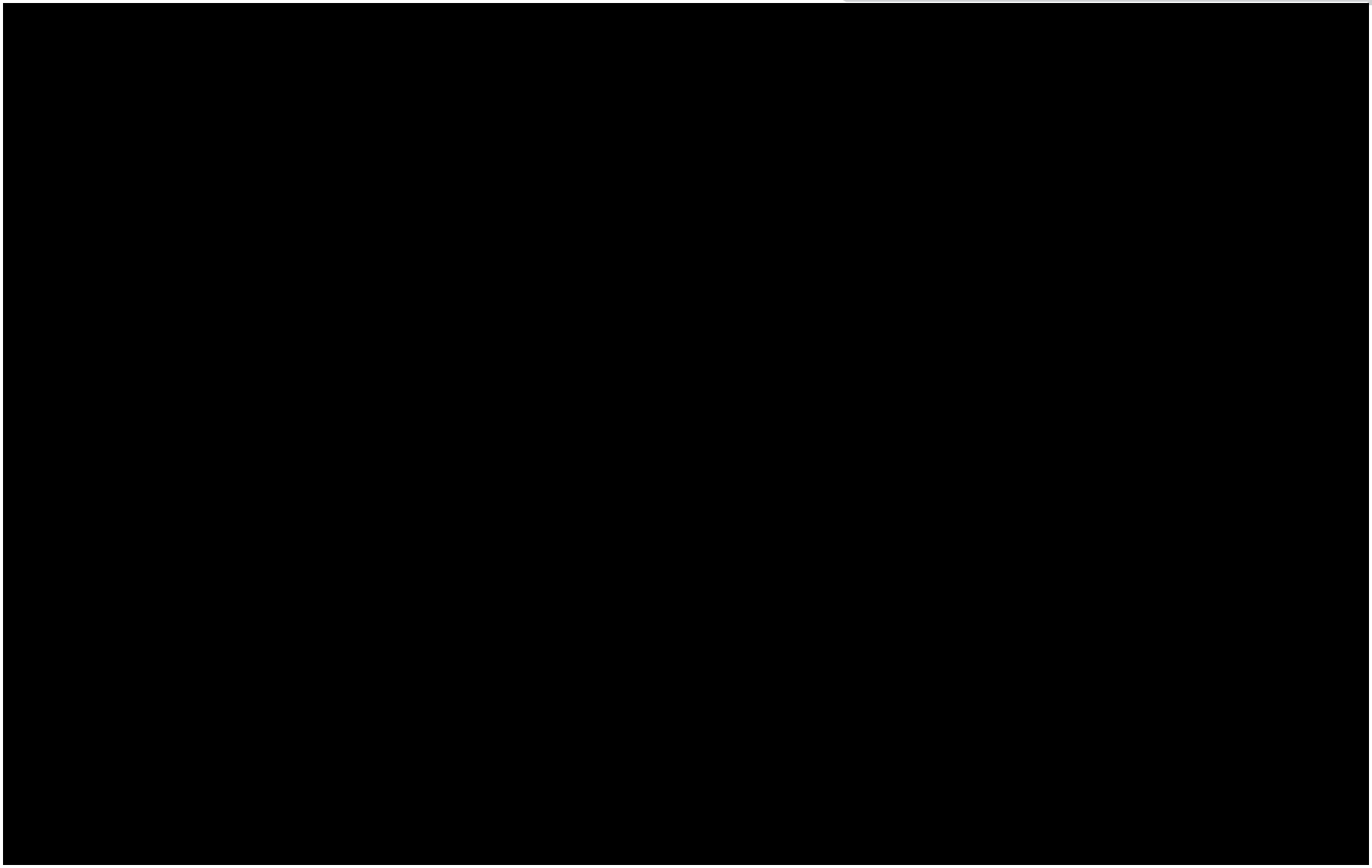

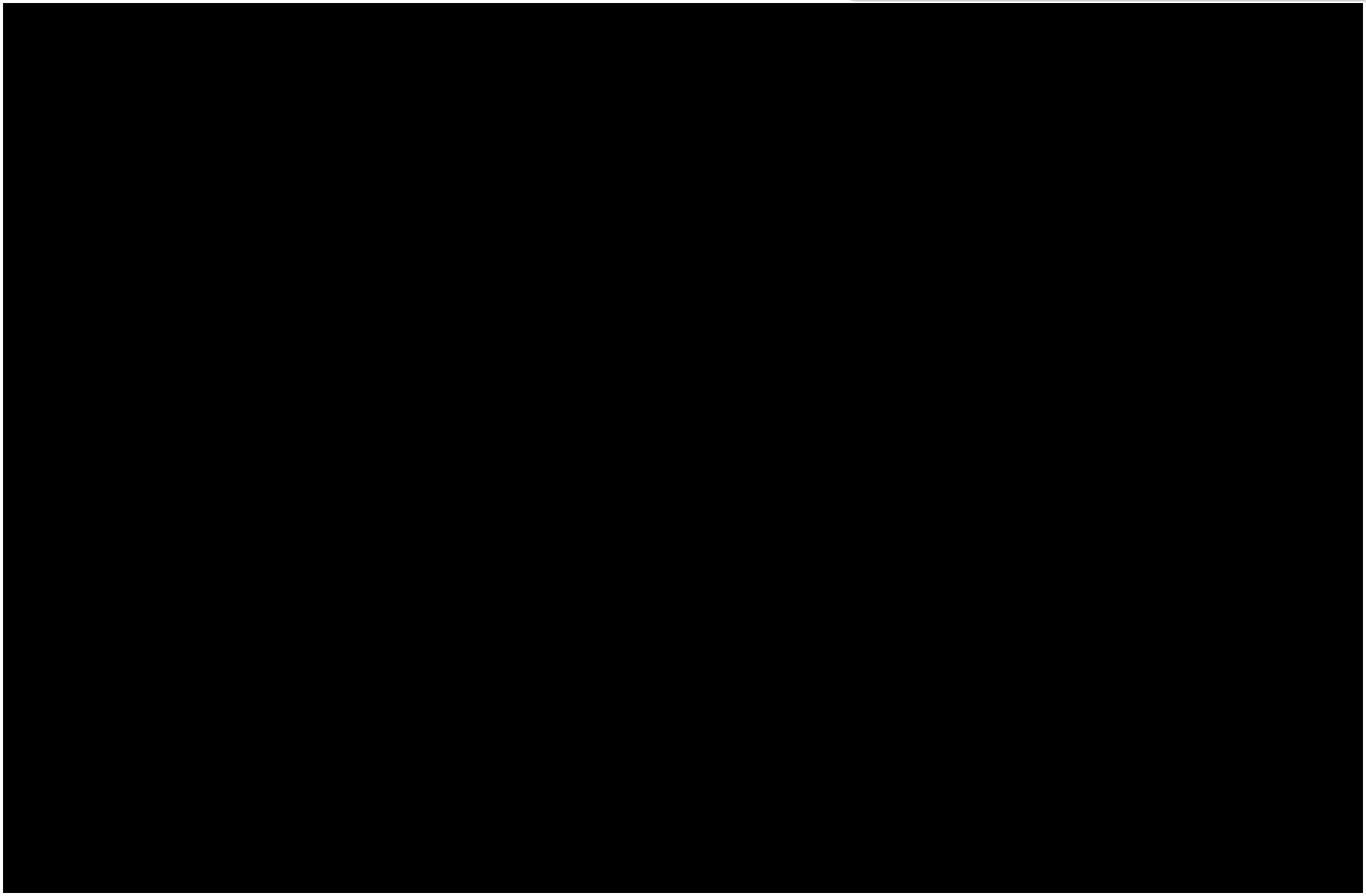

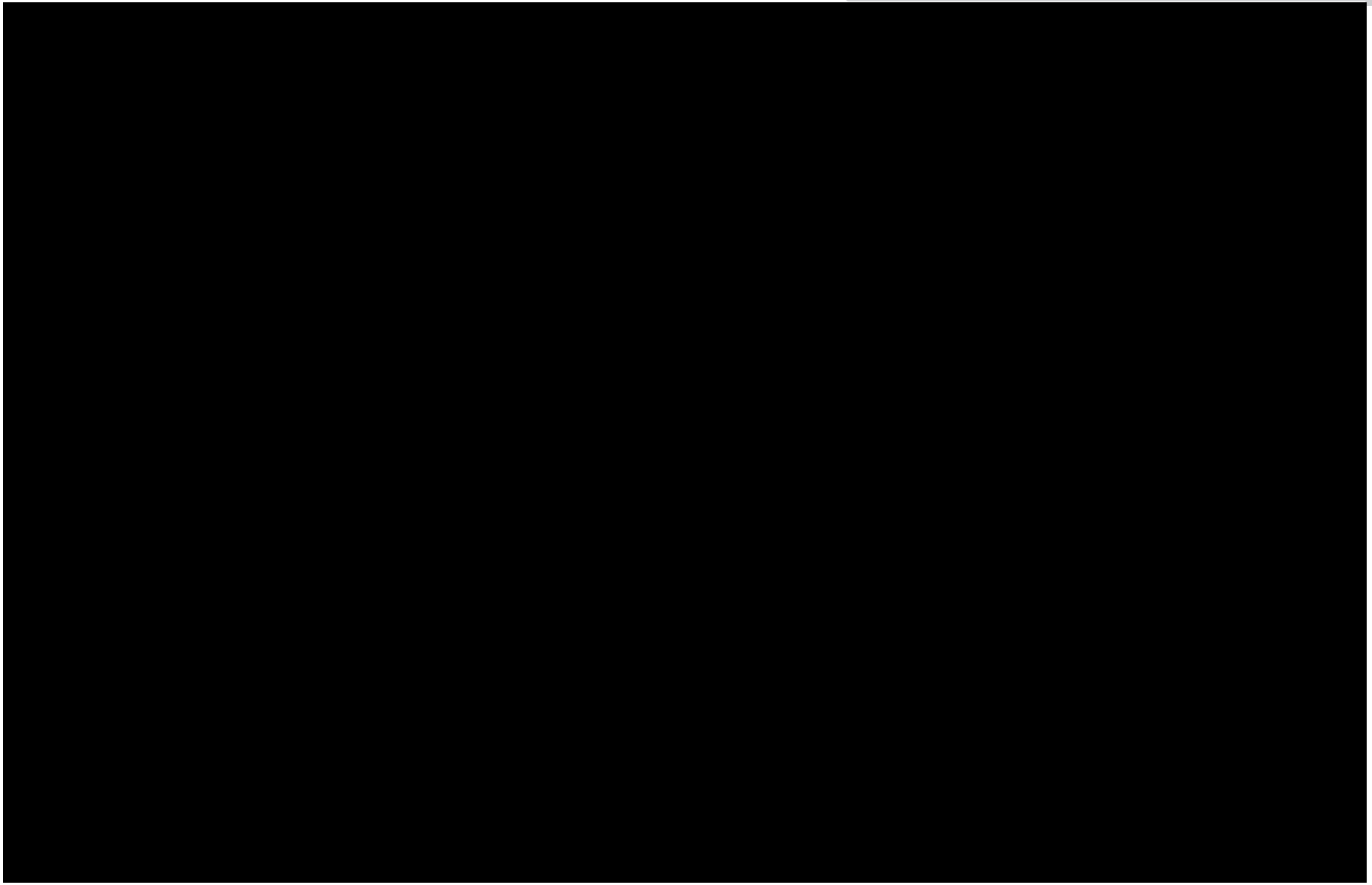

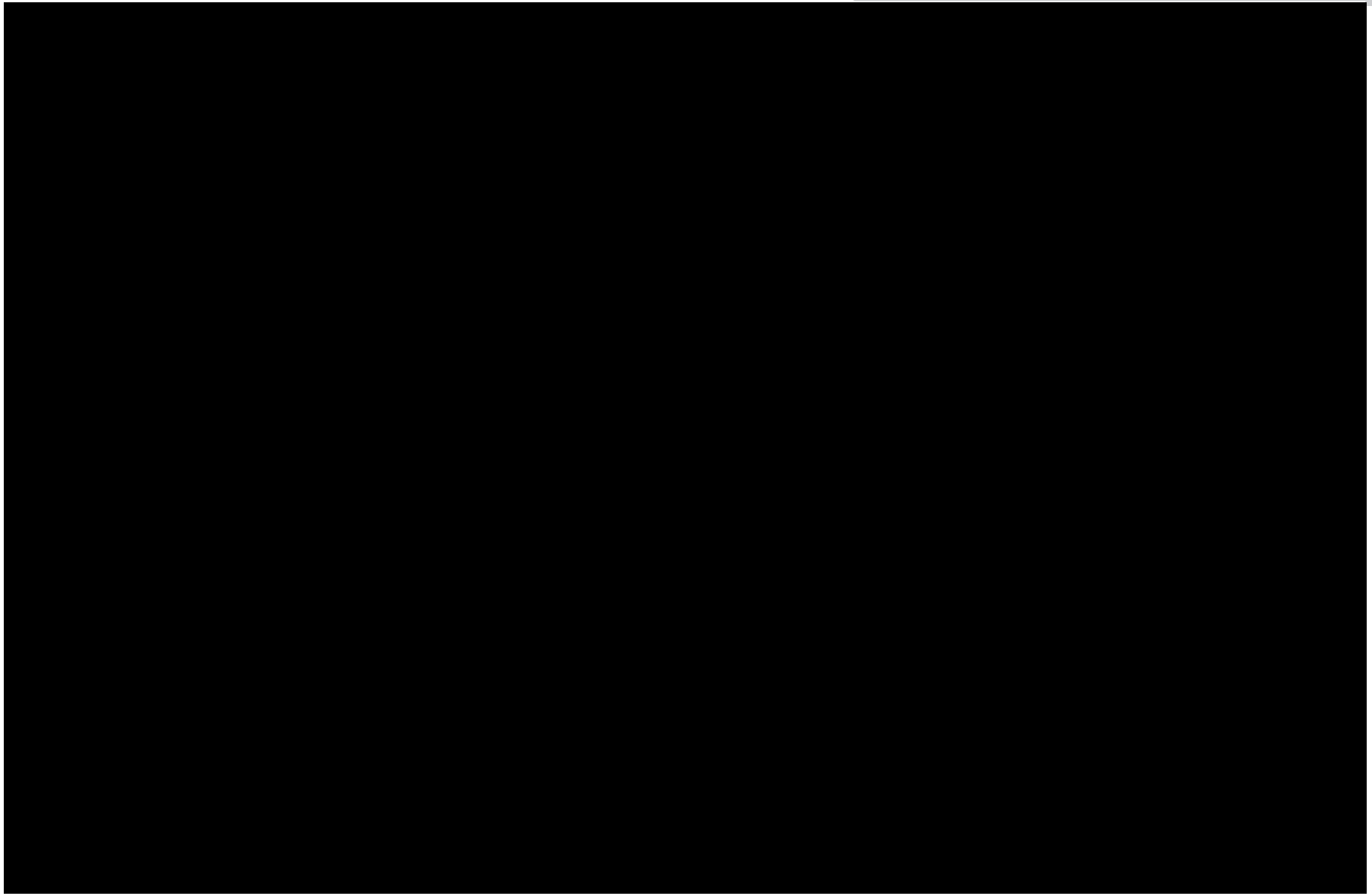

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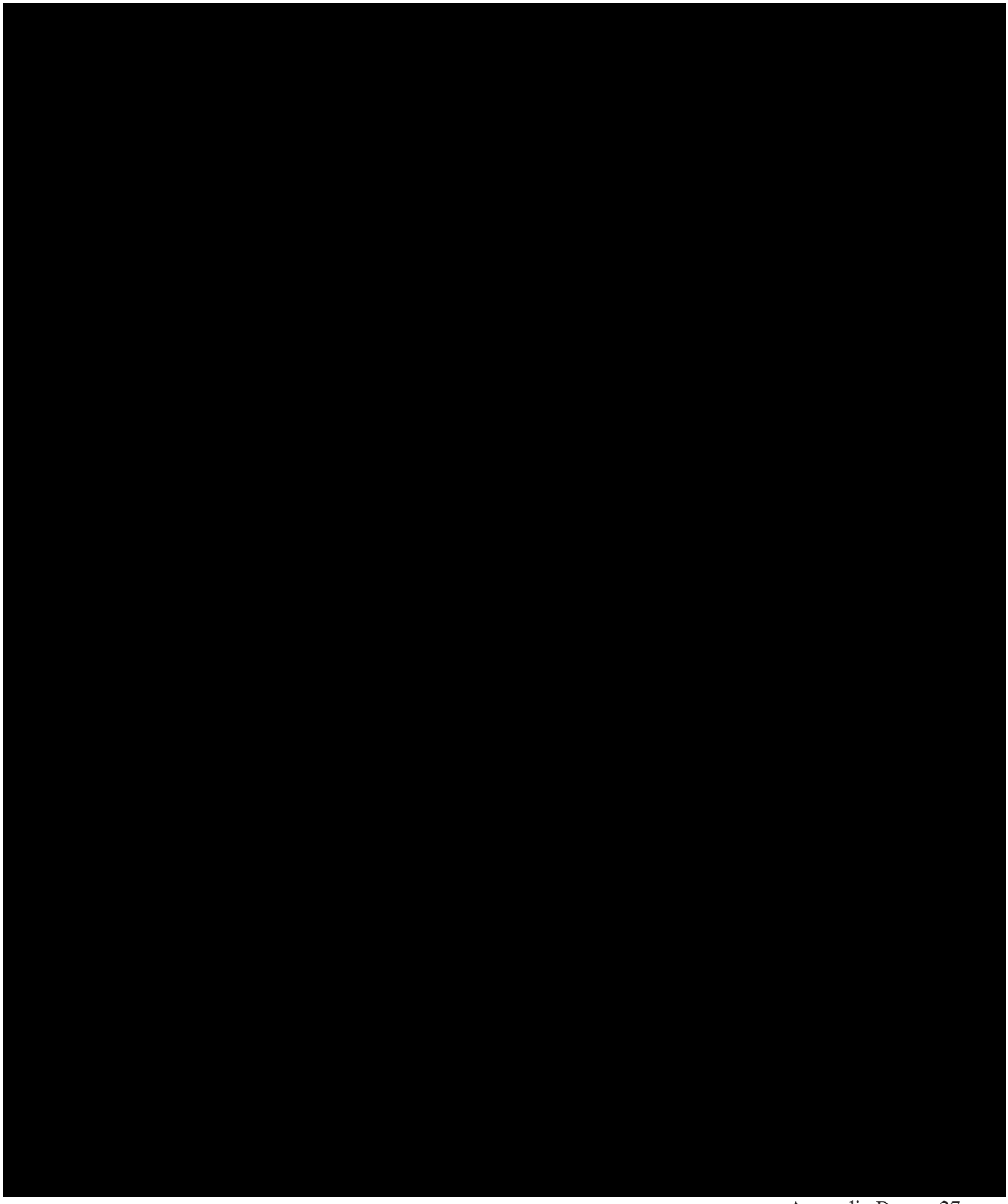

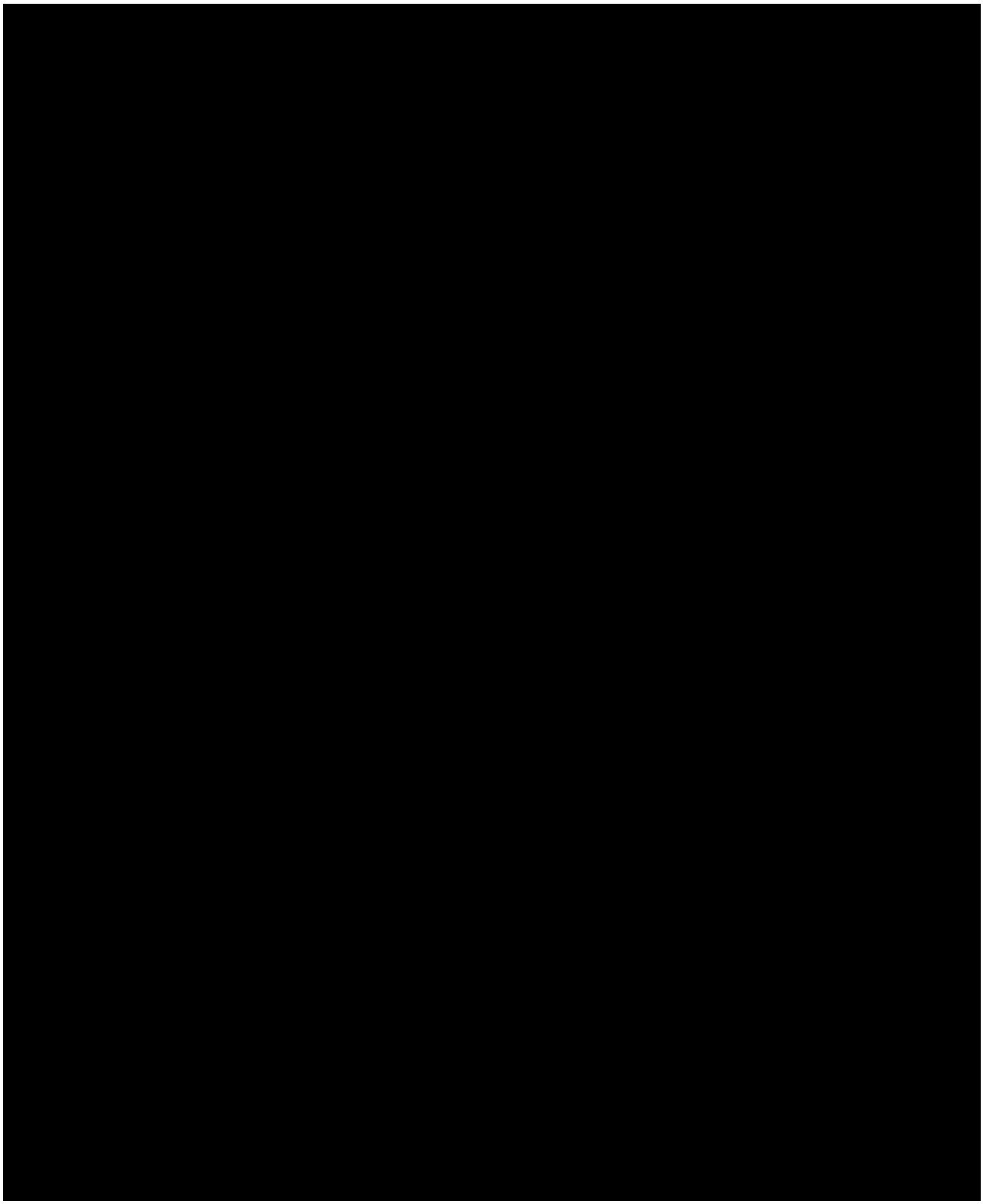

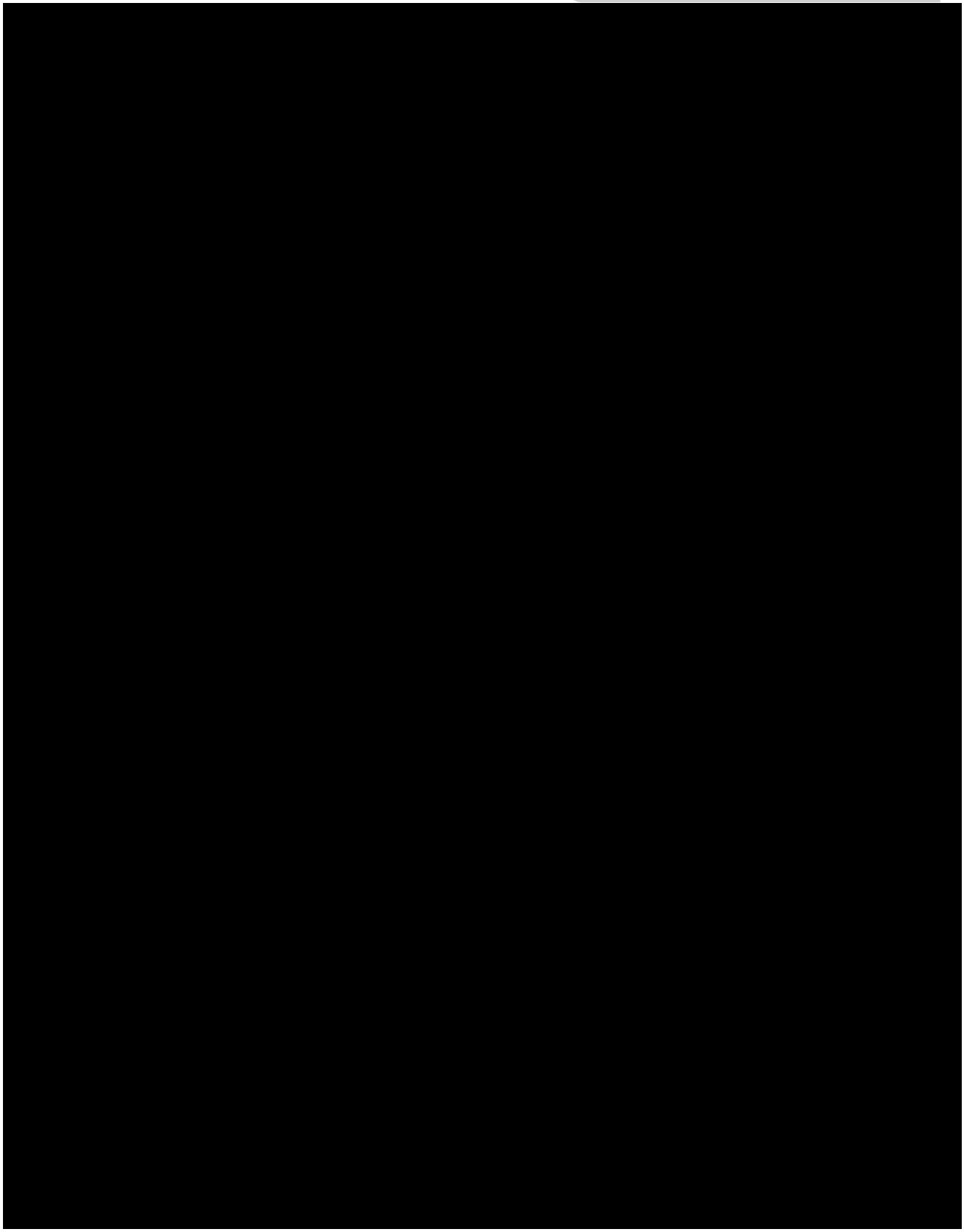

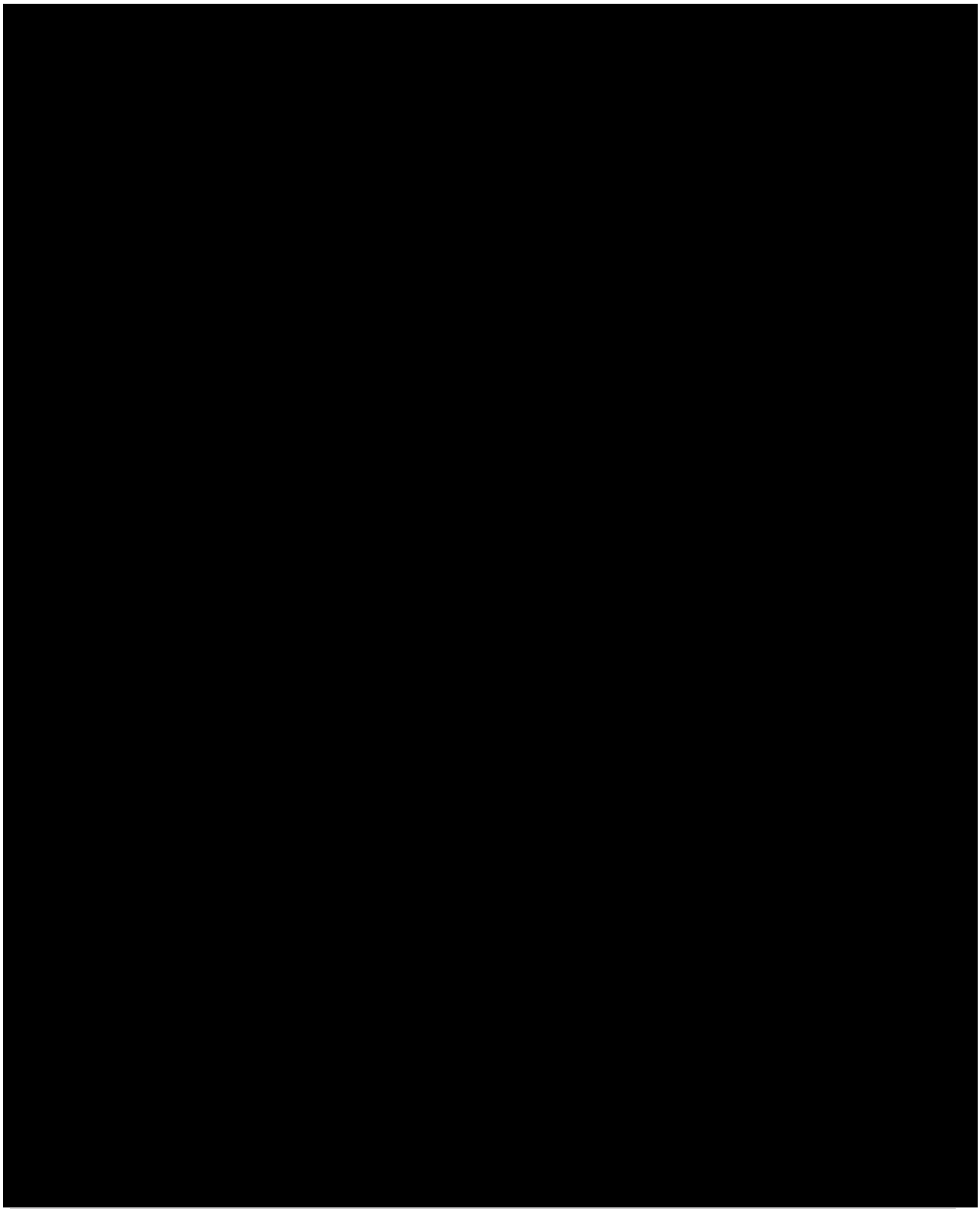

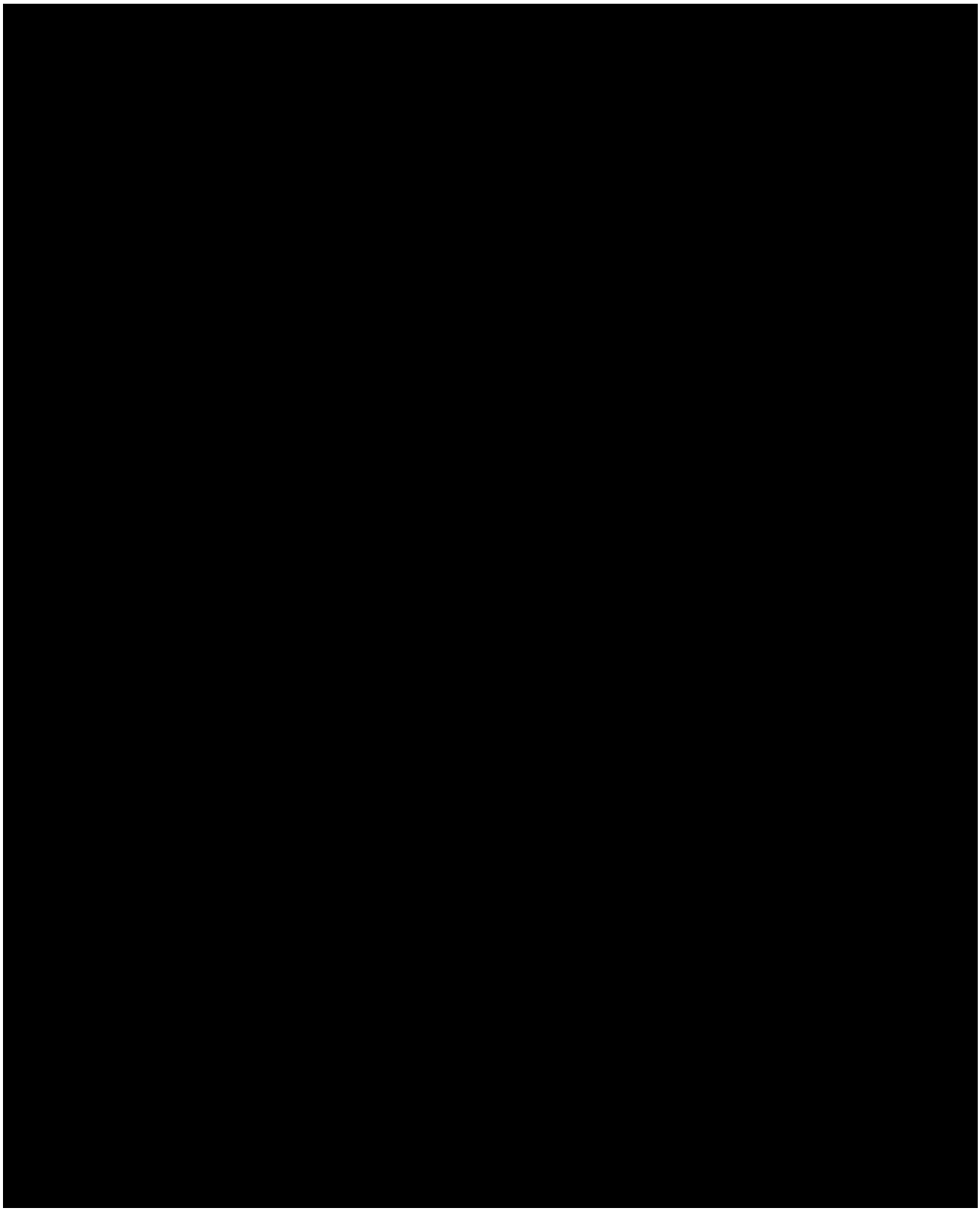

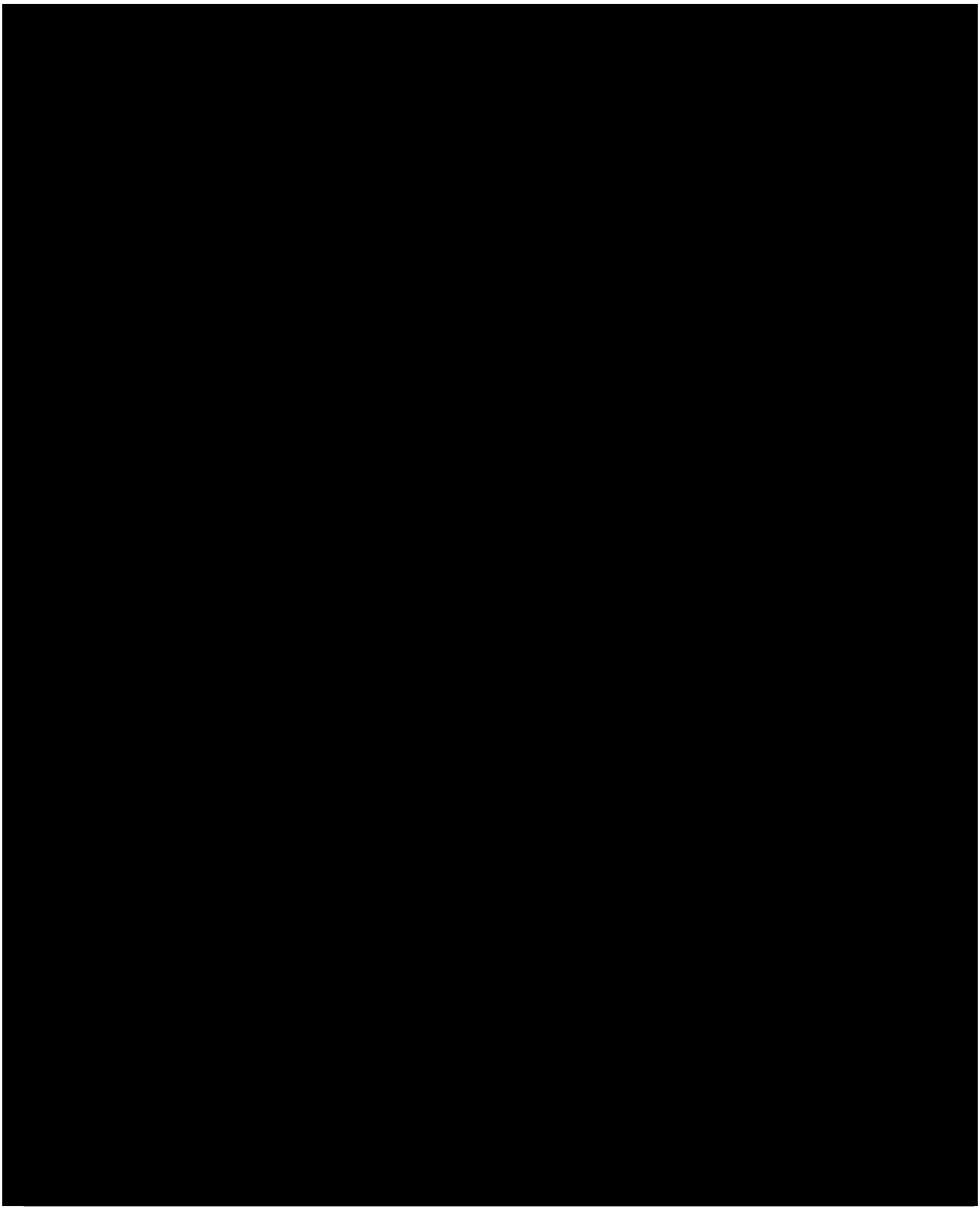

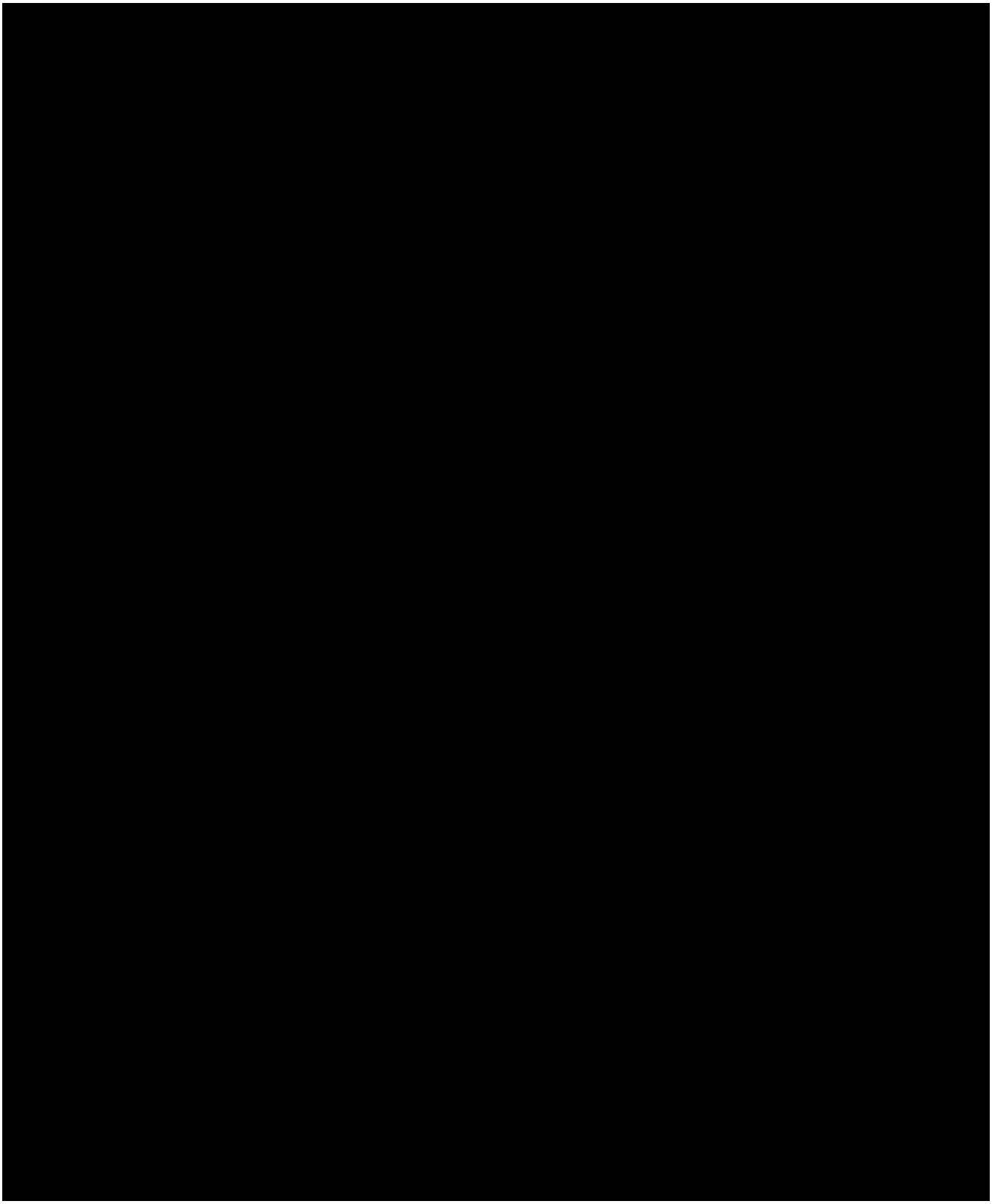

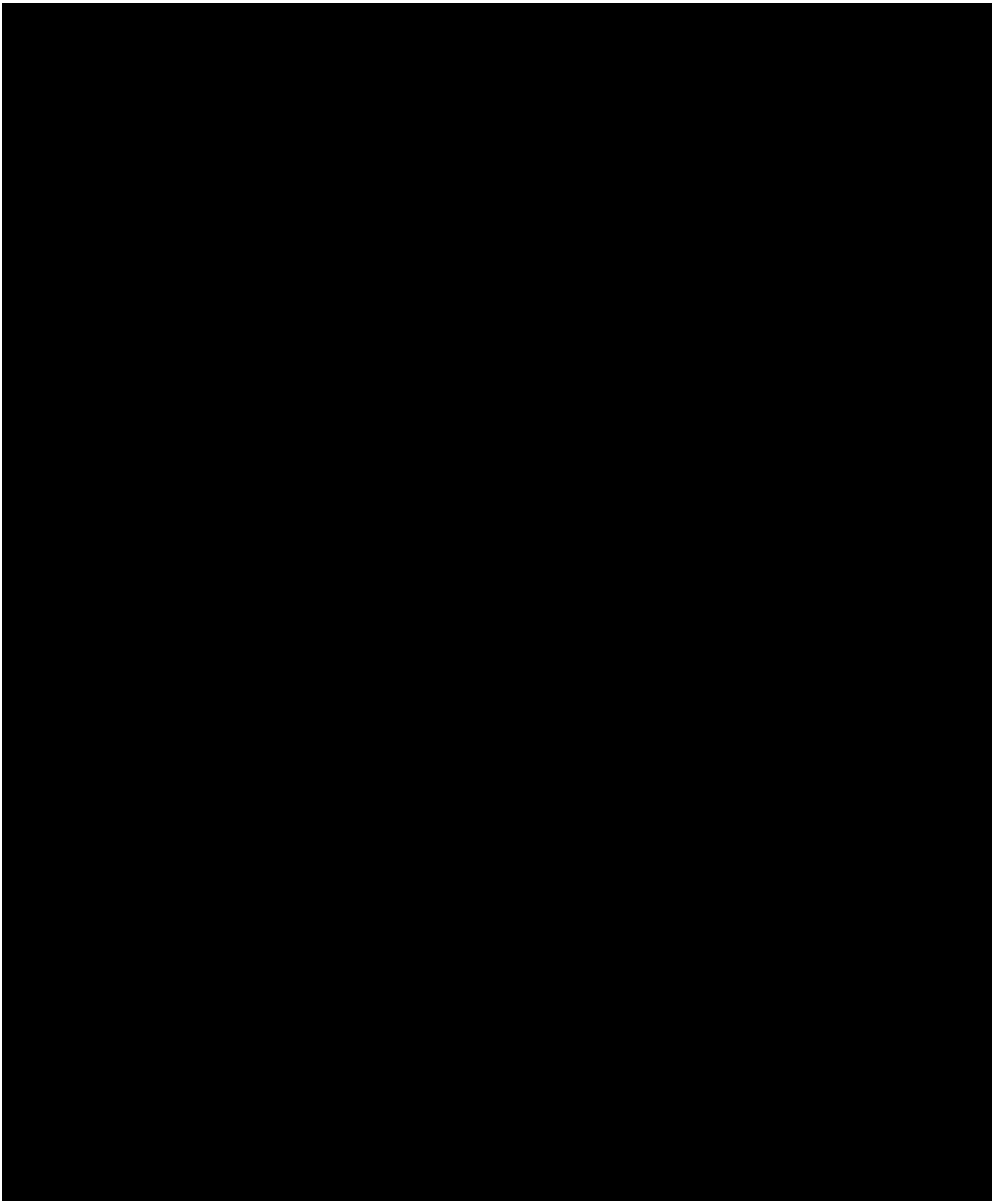

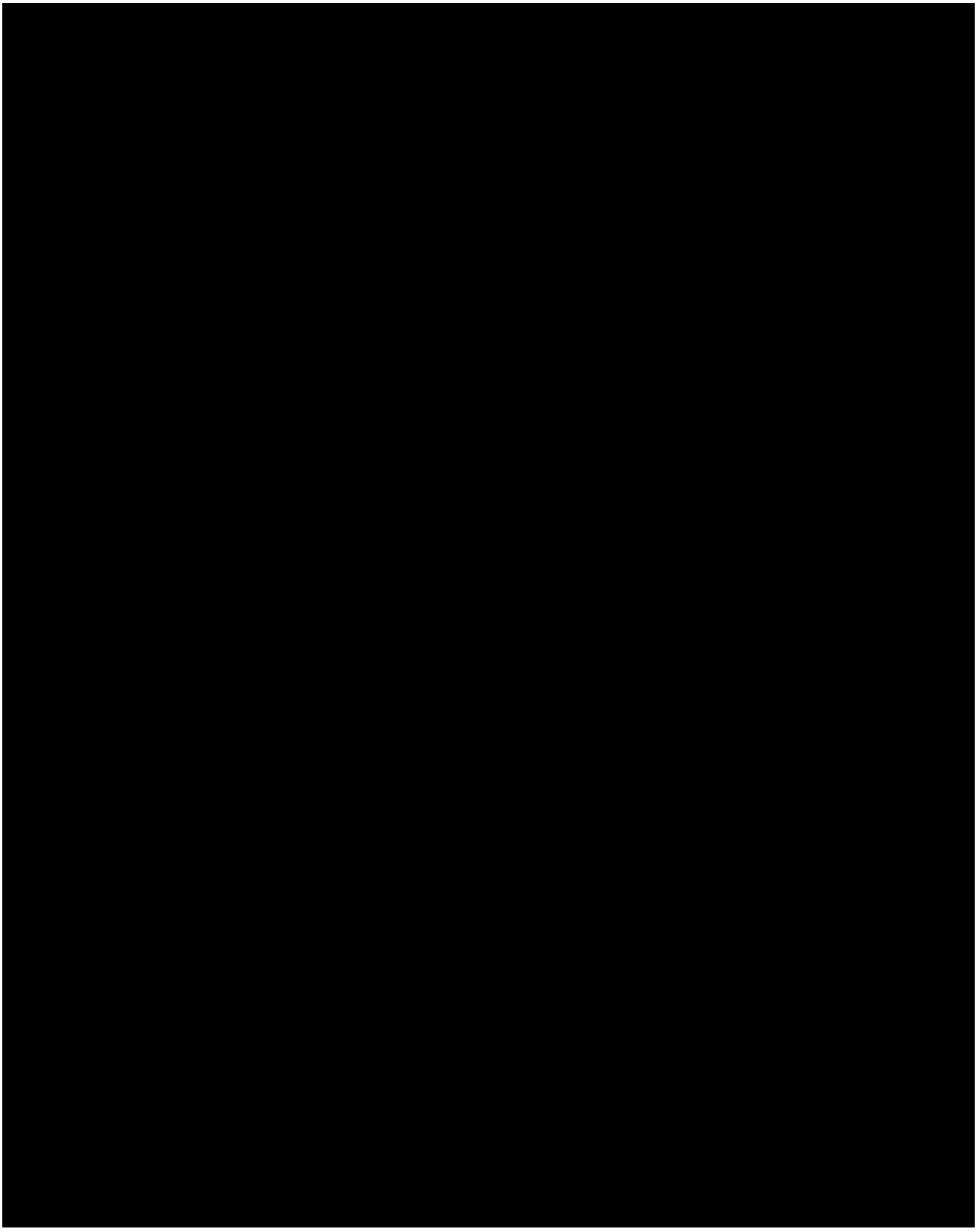

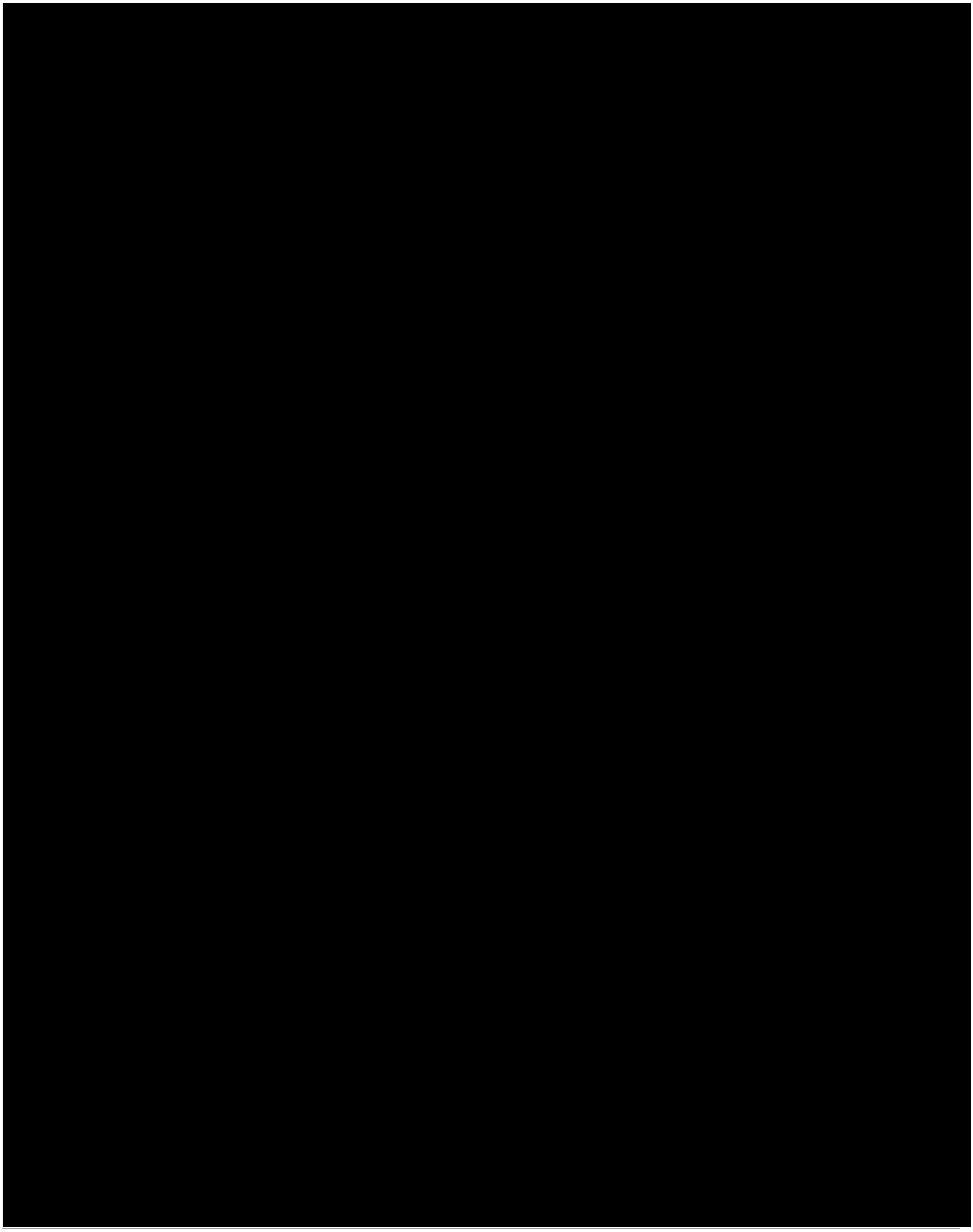

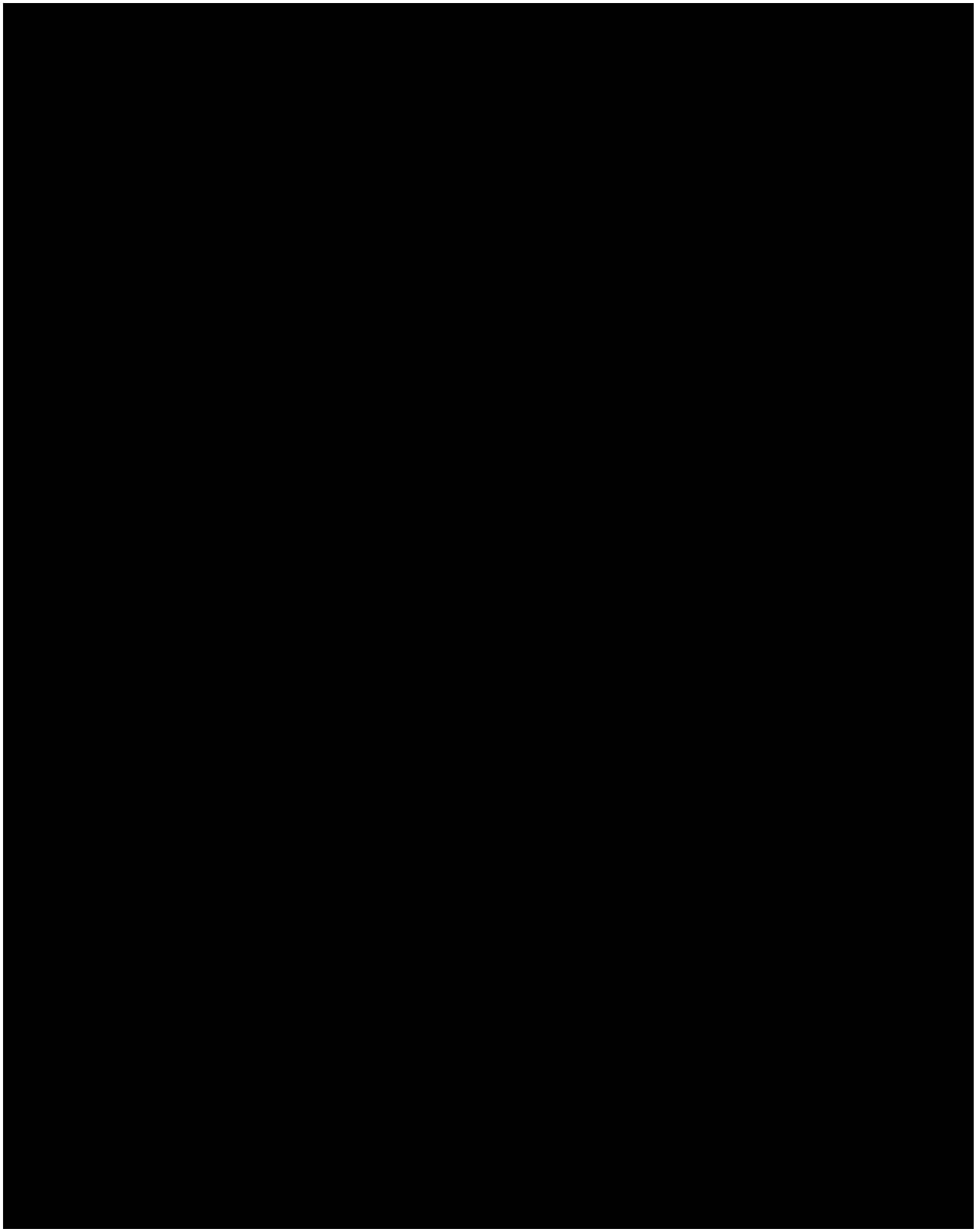

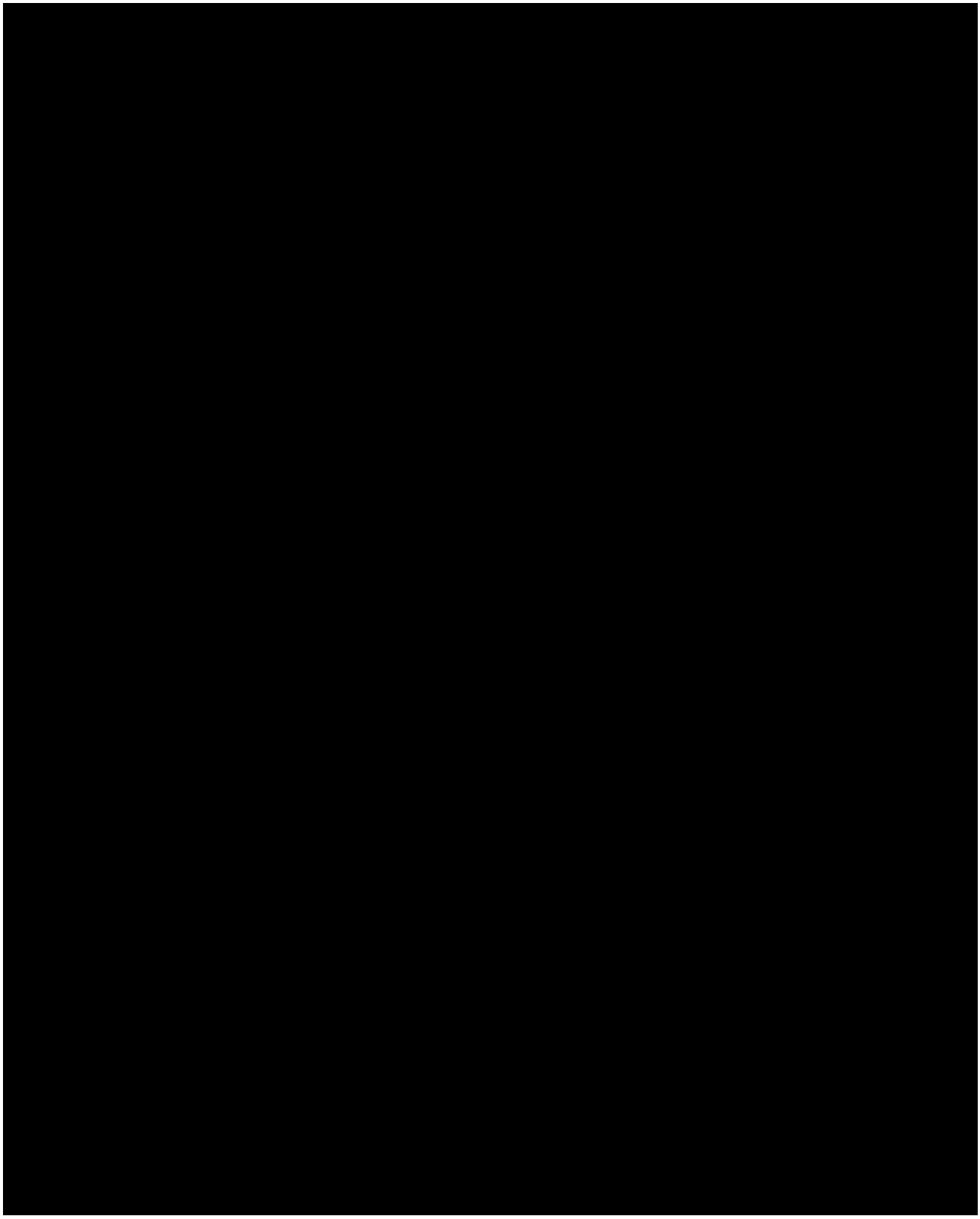

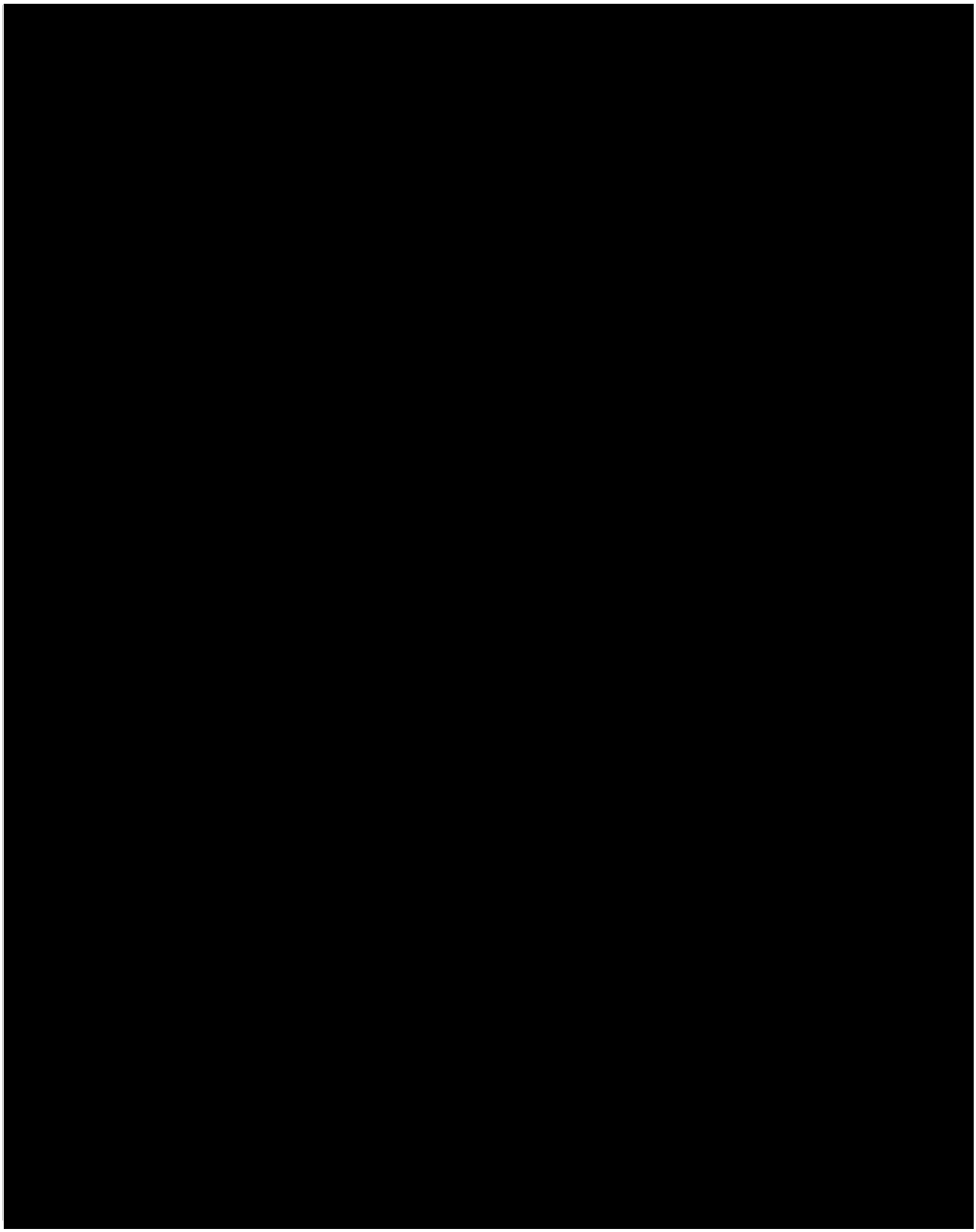

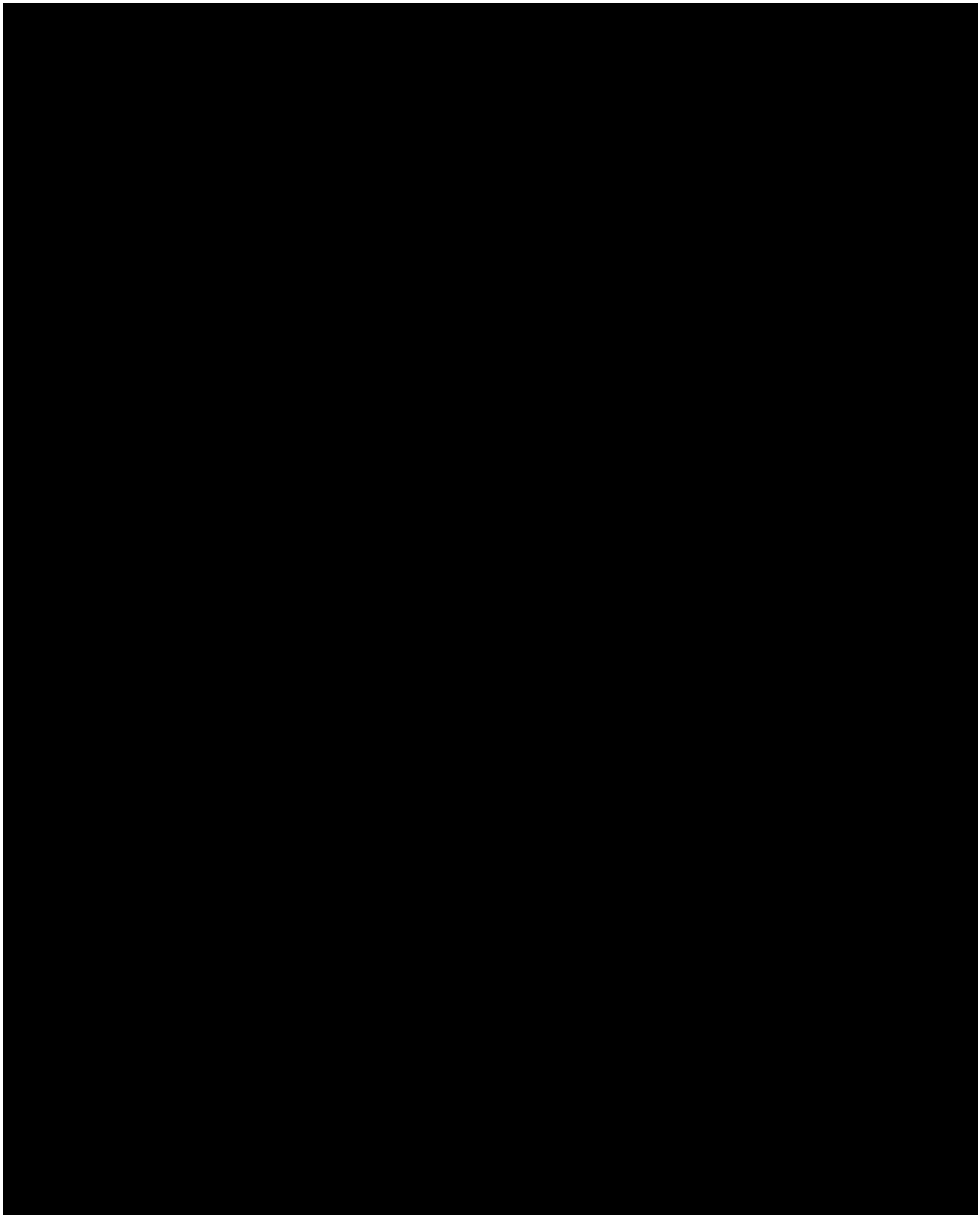

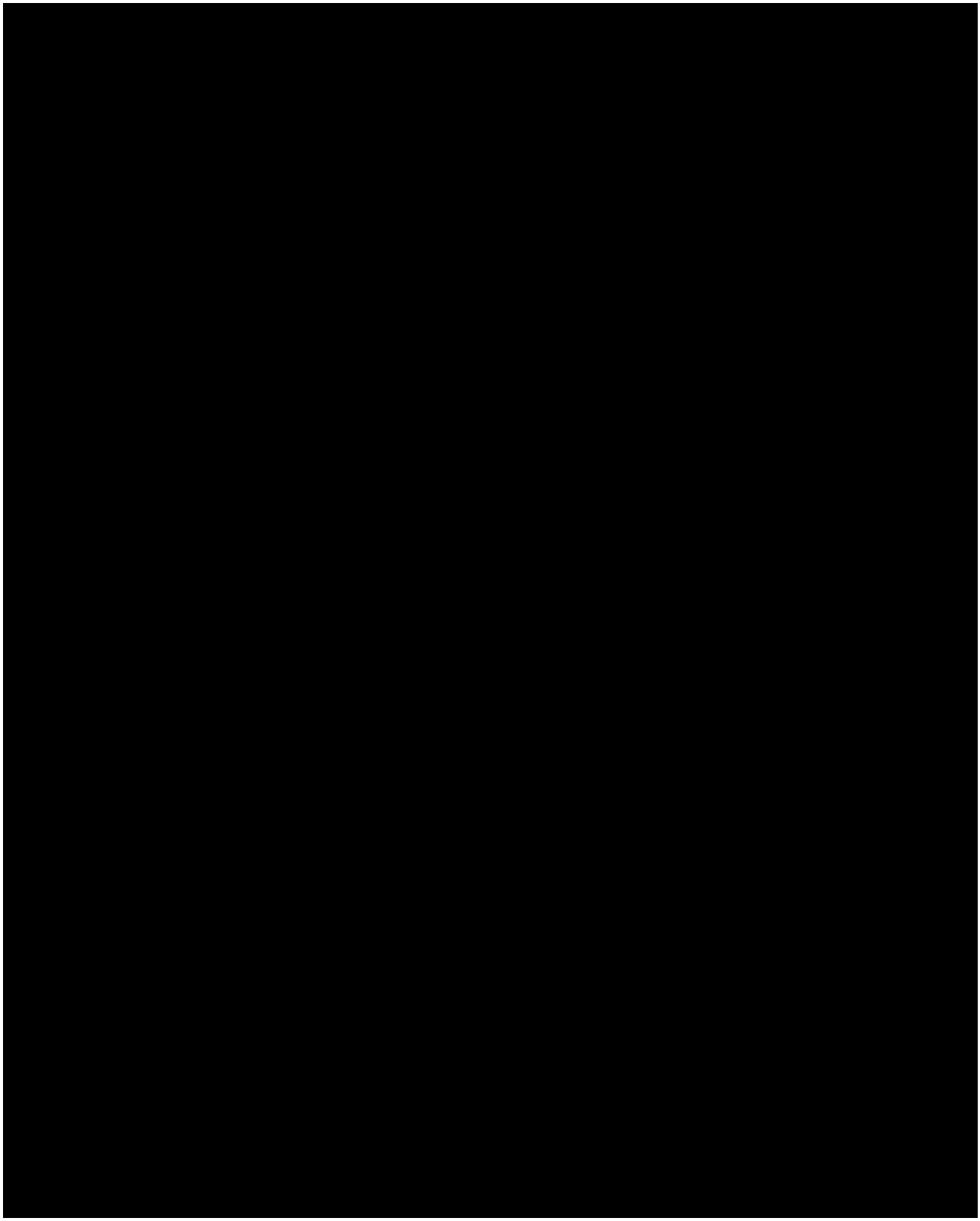

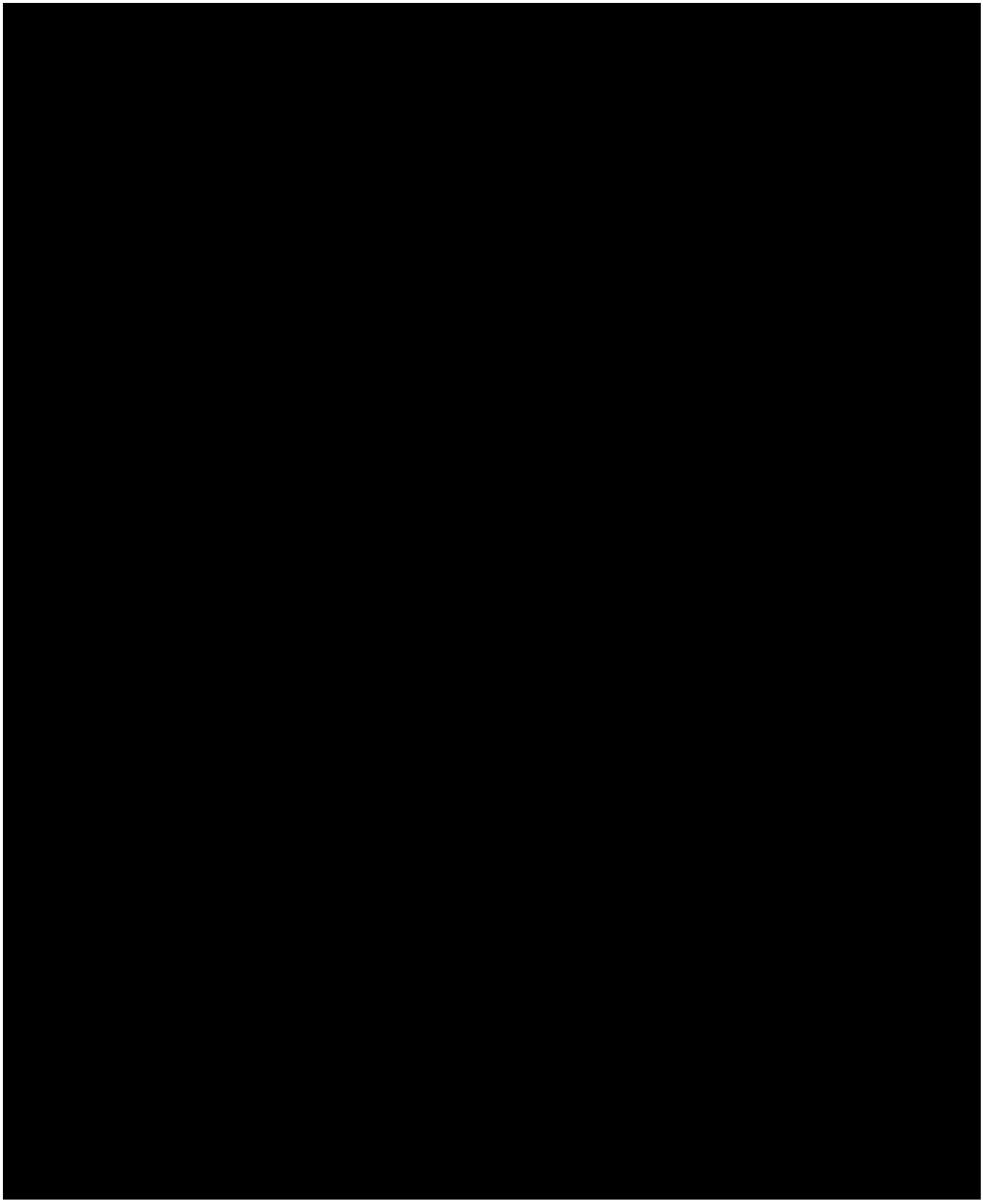

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