REDICA Systems

Insights from Mapping API Inspection Deficiencies to the Quality Systems

Jerry Chapman

Senior GMP Quality Expert, Redica Systems

Agenda

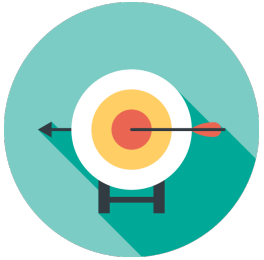
- Introduction
- Data Sources and QSL Models
- The Global 483 Landscape
- How API Regulation Differs – ICH Q7
- API 483s vs. FDF 483s and Some Insights
- Some Specific API 483 Observations
- Conclusions

In theory, the mission is simple:

make safe, high-quality products while meeting regulatory requirements and business demands. But...

Growth in Number of Regulatory Agencies and Requirements…

Health agencies rules and regulations vs. *how they are enforced on inspection*.



What are their expectations for your plant?

Where are those changing expectations found?

How do you find the “C” in CGMP ?

Mining Enforcement Data

Where is enforcement data found?

483
Observations,
Warning Letter Citations

- ✗ Time consuming and difficult
- ✗ Requires expertise

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Data Sources, How We Organize and Use Them

Data Sources

- **All data from PUBLIC sources**
- FDA Inspections databases (CLIIL and FACTS)
- FDA CFR Citations database
- Warning Letters from FDA.gov
- >100k regulatory documents – 483s, Warning Letters, Untitled Letters, Certificates of Non-Conformance, Regulations, Guidance, etc.
- FDA registration databases (e.g., GDUFA)
- FDA 21 CFR 211 catalogue (Cornell University)
- **Team of data scientists/engineers**
- **Experts** – Jerry Chapman (GMP), Barbara Unger (GMP), Jane Wastl (GMP), Alison Sathe (Medical Devices), Fran Lambetecchio (GVP/GCP), Brian Campbell (H&S), Joe Albanese (Pharmacopeia)

Site Tags

- CDER
  - Rx manufacturing (API and FDF)
  - Over-the-Counter (OTC)
  - Other CDER (e.g., excipients)
  - GCP (Clinical Investigators, IRBs, Sponsors)
  - Compounding Pharmacies
- CBER
- CDRH
- MHRA
- Health Canada
- Etc.

How Do We Use the Data

- Investigator profiles
- CMO/CRO due diligence
- Vendor selection
- Inspection preparation
- Keeping PQS up to date
- Tracking changes to authoritative sources
- Tracking and trending inspection observations
- Finding observations and citations “hiding in plain sight”
- Tip of the iceberg…

NOTE: All data and graphs in this presentation are sourced from Redica Systems’ data platform.

Includes all FDA inspected and registered sites since 2000. 20 times more data than has been released on FDA.gov (targeted FOI). More than 300,000 sites and 940,000 inspections.

- Once you get the inspection data, do you have the experts to analyze it?
- And if so, do they still print hard copies and use highlighting markers to analyze them?
- Built proprietary “QSL” models using machine learning and honed by industry experts

Key Takeaway:
Redica Systems has more publicly-available documents in these areas than any non-governmental entity

Building and Applying the QSL Models

- **Quality System Labeling (QSL) models** for human drugs (FDF; API coming soon), medical devices, and GCP|CI are built, tested and deployed
- Other expert models, *e.g.*, for Human Cell and Tissue Products / GTP, GCP|IRB, Human Drug Recalls, and for other inspectorates such as Health Canada and EMA have been built and are in the testing phase
- The models are organized differently to match the topic, although the FDA Quality Systems rubric is very useful.

Using Expert Systems and NLP Tools to Organize the Data

Raw 483s in picture files are useless – they can only be read by humans

- The documents must be made machine readable, then…

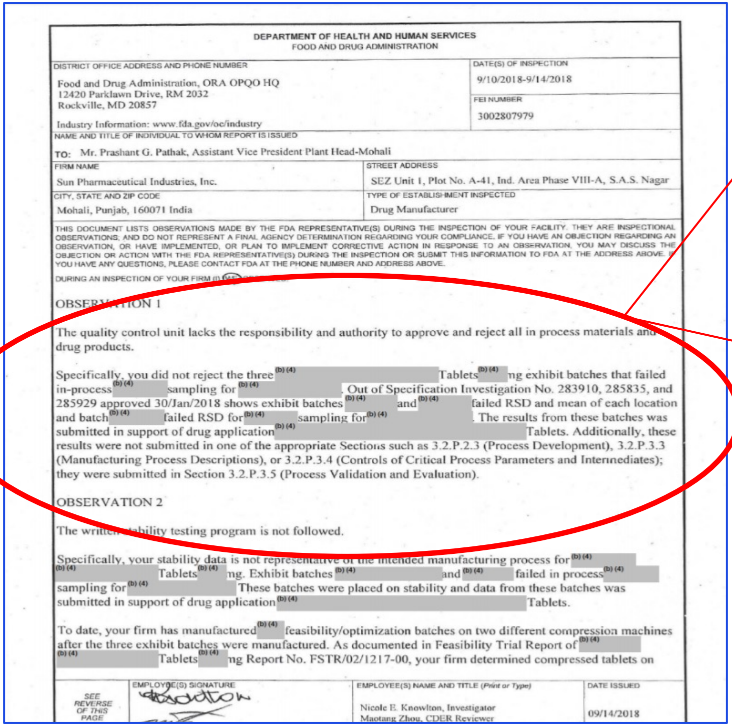
Natural Language Processing (NLP) tools:

- Text parsing
- Text Cleaning
- Tokenization
- Parts of speech tagging
- Stemming
- N-grams

Key Takeaway:

Data sets must be machine readable, and NLP processed for proper analysis

Preparation for NLP Tools: Make Scans Machine Readable, Searchable


DEPARTMENT OF HEALTH AND HUMAN SERVICES
FOOD AND DRUG ADMINISTRATION

DISTRICT OFFICE ADDRESS AND PHONE NUMBER	DATE(S) OF INSPECTION
Food and Drug Administration, ORA OPQO HQ 12420 Parklawn Drive, RM 2032 Rockville, MD 20857 Industry Information: www.fda.gov/oc/industry	9/10/2018-9/14/2018 FEI NUMBER 3002807979

NAME AND TITLE OF INDIVIDUAL TO WHOM REPORT IS ISSUED
TO: Mr. Prashant G. Pathak, Assistant Vice President Plant Head-Mohali

FIRM NAME	STREET ADDRESS
Sun Pharmaceutical Industries, Inc.	SEZ Unit 1, Plot No. A-41, Ind. Area Phase VIII-A, S.A.S. Nagar
CITY, STATE AND ZIP CODE	TYPE OF ESTABLISHMENT INSPECTED
Mohali, Punjab, 160071 India	Drug Manufacturer

THIS DOCUMENT LISTS OBSERVATIONS MADE BY THE FDA REPRESENTATIVE(S) DURING THE INSPECTION OF YOUR FACILITY. THEY ARE INSPECTIONAL OBSERVATIONS, AND DO NOT REPRESENT A FINAL AGENCY DETERMINATION REGARDING YOUR COMPLIANCE. IF YOU HAVE AN OBJECTION REGARDING AN OBSERVATION, OR HAVE IMPLEMENTED, OR PLAN TO IMPLEMENT CORRECTIVE ACTION IN RESPONSE TO AN OBSERVATION, YOU MAY DISCUSS THE OBJECTION OR ACTION WITH THE FDA REPRESENTATIVE(S) DURING THE INSPECTION OR SUBMIT THIS INFORMATION TO FDA AT THE ADDRESS ABOVE. IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT FDA AT THE PHONE NUMBER AND ADDRESS ABOVE.

DURING AN INSPECTION OF YOUR FIRM (I) (WE) OBSERVED:

OBSERVATION 1

The quality control unit lacks the responsibility and authority to approve and reject all in process materials and drug products.

Specifically, you did not reject the three (b) (4) [redacted] Tablets (b) (4) [redacted] mg exhibit batches that failed in-process (b) (4) [redacted] sampling for (b) (4) [redacted]. Out of Specification Investigation No. 283910, 285835, and 285929 approved 30/Jan/2018 shows exhibit batches (b) (4) [redacted] and (b) (4) [redacted] failed RSD and mean of each location and batch (b) (4) [redacted] failed RSD for (b) (4) [redacted] sampling for (b) (4) [redacted]. The results from these batches was submitted in support of drug application (b) (4) [redacted] Tablets. Additionally, these results were not submitted in one of the appropriate Sections such as 3.2.P.2.3 (Process Development), 3.2.P.3.3 (Manufacturing Process Descriptions), or 3.2.P.3.4 (Controls of Critical Process Parameters and Intermediates); they were submitted in Section 3.2.P.3.5 (Process Validation and Evaluation).

OBSERVATION 2

The written stability testing program is not followed.

Specifically, your stability data is not representative of the intended manufacturing process for (b) (4) [redacted] Tablets (b) (4) [redacted] mg. Exhibit batches (b) (4) [redacted] and (b) (4) [redacted] failed in process (b) (4) [redacted] sampling for (b) (4) [redacted] These batches were placed on stability and data from these batches was submitted in support of drug application (b) (4) [redacted] Tablets.

To date, your firm has manufactured (b) (4) [redacted] feasibility/optimization batches on two different compression machines after the three exhibit batches were manufactured. As documented in Feasibility Trial Report of (b) (4) [redacted] Tablets (b) (4) [redacted] mg Report No. FSTR/02/1217-00, your firm determined compressed tablets on

SEE REVERSE OF THIS PAGE	EMPLOYEE(S) SIGNATURE	EMPLOYEE(S) NAME AND TITLE (Print or Type)	DATE ISSUED
		Nicole E. Knowlton, Investigator Maotang Zhou, CDER Reviewer	09/14/2018

Clean Observation Text: OCR, Retyping

Observation 1 of 2

OBSERVATION 1

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Specifically, you did not reject the three (b) (4)~~~~~~~~~~~~~~~~~~~~~ Tablets(b) (4)~~mg exhibit batches that failed in-process (b) (4)~~~~~~~~sampling for (b) (4)~~~~~~~~~~. Out of Specification Investigation No. 283910, 285835, and 285929 approved 30/Jan/2018 shows exhibit batches (b) (4)~~~~~and (b) (4)~~~~~failed RSD and mean of each location and batch (b) (4)~~~~~~~failed RSD for (b) (4)~~~~~~~sampling for (b) (4)~~~~~~~~~~~~~~~. The results from these batches was
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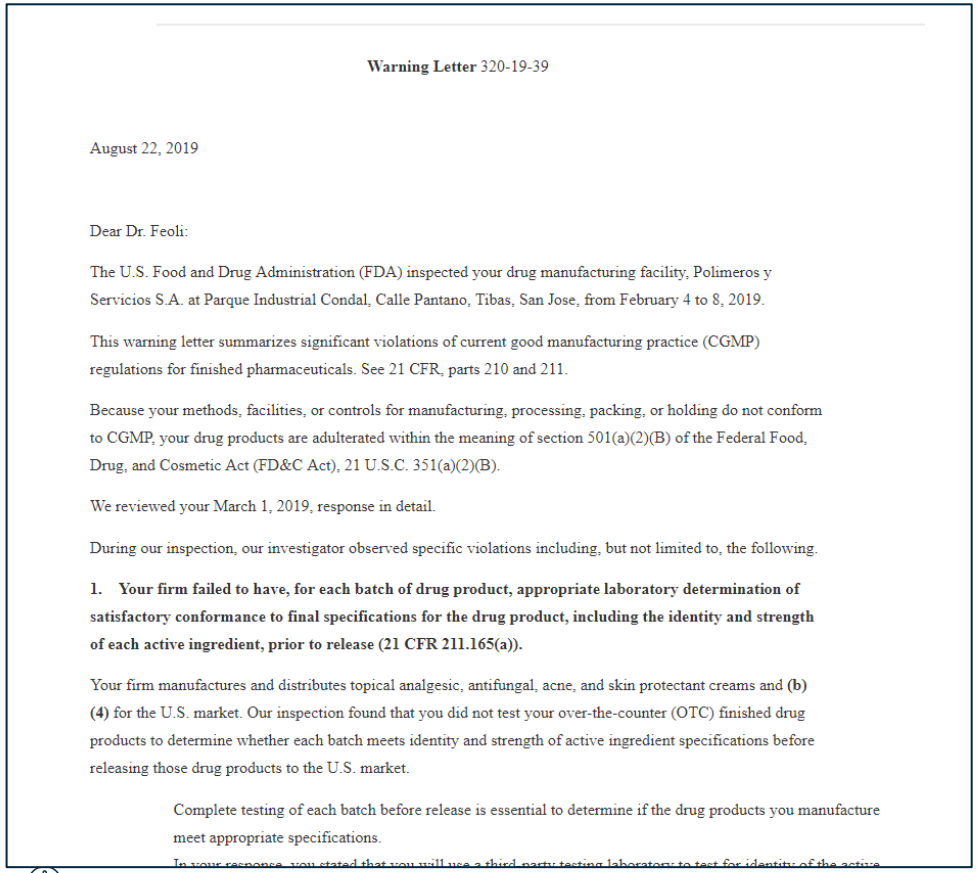
Make it machine readable and searchable:

The quality control unit lacks the responsibility and authority to approve and reject all in process materials and drug products.

Natural Language Processing: Text Parsing



Warning Letter 320-19-39

August 22, 2019

Dear Dr. Feoli:

The U.S. Food and Drug Administration (FDA) inspected your drug manufacturing facility, Polimeros y Servicios S.A. at Parque Industrial Condal, Calle Pantano, Tibas, San Jose, from February 4 to 8, 2019.

This warning letter summarizes significant violations of current good manufacturing practice (CGMP) regulations for finished pharmaceuticals. See 21 CFR, parts 210 and 211.

Because your methods, facilities, or controls for manufacturing, processing, packing, or holding do not conform to CGMP, your drug products are adulterated within the meaning of section 501(a)(2)(B) of the Federal Food, Drug, and Cosmetic Act (FD&C Act), 21 U.S.C. 351(a)(2)(B).

We reviewed your March 1, 2019, response in detail.

During our inspection, our investigator observed specific violations including, but not limited to, the following.

1. Your firm failed to have, for each batch of drug product, appropriate laboratory determination of satisfactory conformance to final specifications for the drug product, including the identity and strength of each active ingredient, prior to release (21 CFR 211.165(a)).

Your firm manufactures and distributes topical analgesic, antifungal, acne, and skin protectant creams and **(b) (4)** for the U.S. market. Our inspection found that you did not test your over-the-counter (OTC) finished drug products to determine whether each batch meets identity and strength of active ingredient specifications before releasing those drug products to the U.S. market.

Complete testing of each batch before release is essential to determine if the drug products you manufacture meet appropriate specifications.

In your response, you stated that you will use a third-party testing laboratory to test for identity of the active

Drug GMP Warning Letter “parts”

- name
- recipient
- introduction
- deficiency title 1
- deficiency description 1
- deficiency action 1
- deficiency feedback 1
- deficiency title 2
- deficiency description 2
- deficiency action 2
- deficiency feedback 2
- deficiency title n
- deficiency description n
- deficiency action n
- deficiency feedback n
- cgmp consultant recommended
- format_type
- conclusion
- reply_to
- identification number
- footer

Natural Language Processing: Text Parsing

Not all sections are searched. **Parsing is key:**

CFR citation: "Your firm failed to clean, maintain, and, as appropriate for the nature of the drug, sanitize and/or sterilize equipment and utensils at appropriate intervals to prevent malfunctions or contamination that would alter the safety, identity, strength, quality, or purity of the drug product beyond the official or other established requirements. (21 CFR 211.67(a))" [Deficiency Title]

Specifically…

It is the "specifically" or "for example" test that contains rich content [Deficiency Description]

Natural Language Processing: Text Cleaning

Text Cleaning is the process of clearing out the “junk” from a sentence.

Examples:

- Remove extra spaces
- Make all words lowercase
- Remove typos & misspelling

Natural Language Processing: Tokenization

Splitting up a sentence into tokens. The most basic of which is just to split a sentence into individual words.

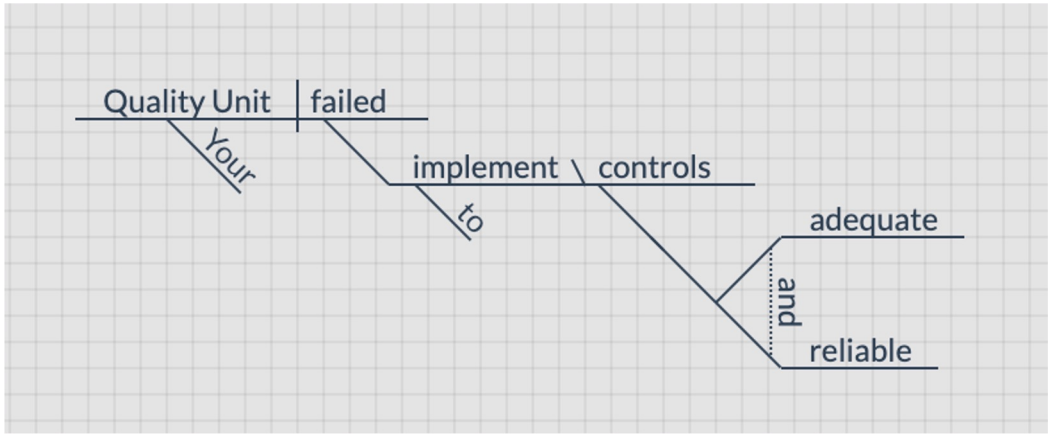
“Your Quality Unit failed to implement adequate and reliable controls for ensuring that distributed drug products always comply with the efficacy and quality they represent to possess.”

['Your', 'Quality', 'Unit', 'failed', 'to', 'implement', 'adequate', 'and', 'reliable', 'controls', 'for', 'ensuring', 'that', 'distributed', 'drug', 'products', 'always', 'comply', 'with', 'the', 'efficacy', 'and', 'quality', 'they', 'represent', 'to', 'possess', '.']

Natural Language Processing: Tokens and Parts of Speech (POS) Tagging

Tokens can be much more complex, in the example below the sentence was broken up into “Part of speech” tokens

“Your Quality Unit failed to implement adequate and reliable controls for ensuring that distributed drug products always comply with the efficacy and quality they represent to possess.”

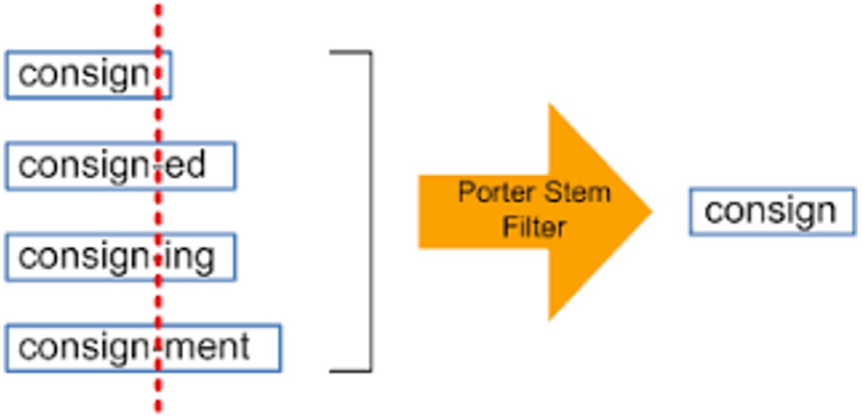


[('Your', 'PRP$'), ('Quality', 'NNP'), ('Unit', 'NNP'), ('failed', 'VBD'), ('to', 'TO'), ('implement', 'VB'), ('adequate', 'JJ'), ('and', 'CC'), ('reliable', 'JJ'), ('controls', 'NNS'), ('for', 'IN'), ('ensuring', 'VBG'), ('that', 'IN'), ('distributed', 'VBN'), ('drug', 'NN'), ('products', 'NNS'), ('always', 'RB'), ('comply', 'VBP'), ('with', 'IN'), ('the', 'DT'), ('efficacy', 'NN'), ('and', 'CC'), ('quality', 'NN'), ('they', 'PRP'), ('represent', 'VBP'), ('to', 'TO'), ('possess', 'VB'), ('.', '.')]

Natural Language Processing: Stemming

Stemming is the process of reducing each word in a written document into its word stem, base or root form. This will not necessarily become a proper word but all permutations of a word will stem to the same root.

“Your Quality Unit failed to implement adequate and reliable controls for ensuring that distributed drug products always comply with the efficacy and quality they represent to possess.”



your qualiti unit fail to implement adequ and reliabl control for ensur that distribut drug product alway compli with the efficaci and qualiti they repres to possess

Natural Language Processing: N-grams

An n-gram is a contiguous sequence of n items from a given sample of text or speech

“Your Quality Unit failed to implement adequate and reliable controls for ensuring that distributed drug products always comply with the efficacy and quality they represent to possess.”

Bi-gram
('Your', 'Quality')
('Quality', 'Unit')
('Unit', 'failed')
('failed', 'to')

Tri-gram
('Your', 'Quality', 'Unit')
('Quality', 'Unit', 'failed')
('Unit', 'failed', 'to')
('failed', 'to', 'implement')
('to', 'implement', 'adequate’).....and longer ones

Subject Matter Experts create n-grams from experience and compliance document language; tested over time in model iterations.

Human Drug GMP Quality System Labeling

Quality System	Packaging & Labeling	Facilities & Equipment	Materials	Laboratory	Production	Data Integrity
• Agency Notification (4 subs) • Audit (2 subs) • CAPA (5 subs) • Change Control (5 subs) • Complaint Management • Records and Reports (17 subs) • Deviations / Investigations (8 subs) • Qualified Personnel (3 subs) • Quality Unit Inadequate (15 subs) • Risk Mgmt.	• Drug product containers and closures (10 subs) • Label and Packaging Controls (5 subs) • Line Clearance • Serialization	• Cleaning (6 subs) • Design (20 subs) • Maintenance (8 subs) • Alarm Management • HVAC • Pest Control • Records and Reports	• Distribution • Material Receipt and Handling (3 subs) • Material Sampling and Testing (11 subs) • Material Storage and Control • Retain Samples	• Laboratory Controls (7 subs) • Method Validation • OOS/ OOT • Stability (2 subs) • Systems Controls • Testing (13 subs) • Reagents and Standards • Records and Reports • Sample Management	• Batch Records • Clean Utilities • Cleaning validation or verification (5 subs) • Contamination Control • High Potency/Allergenic • Nonsterile products (2 subs) • Penicillin and Cephalosporin • Personnel Responsibilities • Process control (5 subs) • Process Monitoring / Continued Process Verification • Process Validation (2 subs) • Product Contamination • Records and Reports • Retain Samples • Sterile Products (22 subs)	• Accurate • Attributable (3 subs) • Backup and Archival • Contemporaneous • Data Destruction • Data Manipulation • Legible • Original Data • Paper Record Controls • System Controls • Testing into Compliance

>200 GMP Categories

Key Takeaway: Data must be organized into a meaningful rubric to understand and communicate it

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Applying the Model: Warning Letter Example

Your firm failed to thoroughly investigate any unexplained discrepancy or failure of a batch or any of its components to meet any of its specifications, whether or not the batch has already been distributed (21 CFR 211.192). [Deficiency Title]

Specifically, your investigations into out-of-specification (OOS) results and process deviations were inadequate. Root causes…

The investigations identified a root cause of untrained or inexperienced operators (b) (4).

The investigation did not fully evaluate the processing factors that contribute to variability in your finished tablets. In particular it did not evaluate the inherent variability of the (b) (4) method used for charging (b) (4) and identify more robust methods for performing this critical transfer that could prevent blend segregation and tablet dose non-uniformity. Deficiency Description

→ Many focus only on the primary observation (in **bold** with CFR)

Applying the Model: Warning Letter Example

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==========

211.192

Potential training issue not cited

Potential dosage uniformity issue not cited

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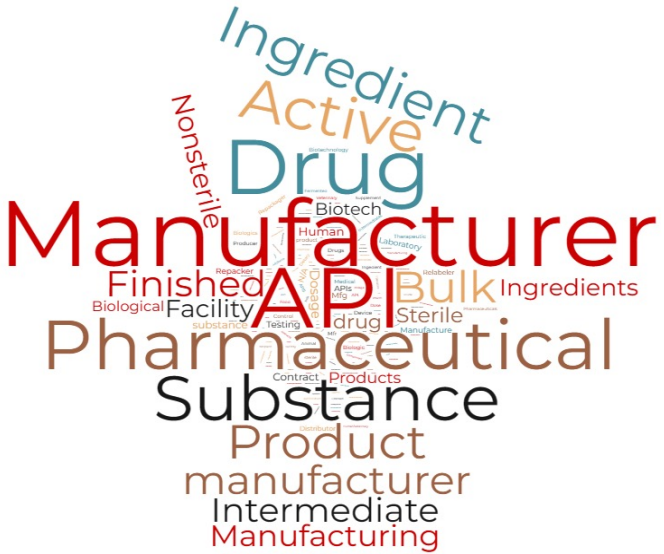
How to Tell API and FDF 483s Apart?

- API 483s in our platform list 185 unique facility types that include APIs
- This is a word cloud* showing the words and frequency
- The most frequent names were
  - API Manufacturer (44%)
  - Drug Substance Manufacturer (8%)
  - Active Pharmaceutical Ingredient Manufacturer (8%), and 180 names that are < 1% each, e.g., Bulk Pharmaceutical Manufacturer, Drug Manufacturer (API), combinations



*Created at wordclouds.com

Key Takeaway:

Using the type of establishment inspected to find API 483s is challenging

Number of API and FDF 483s We Have by Country 2000 - 2022

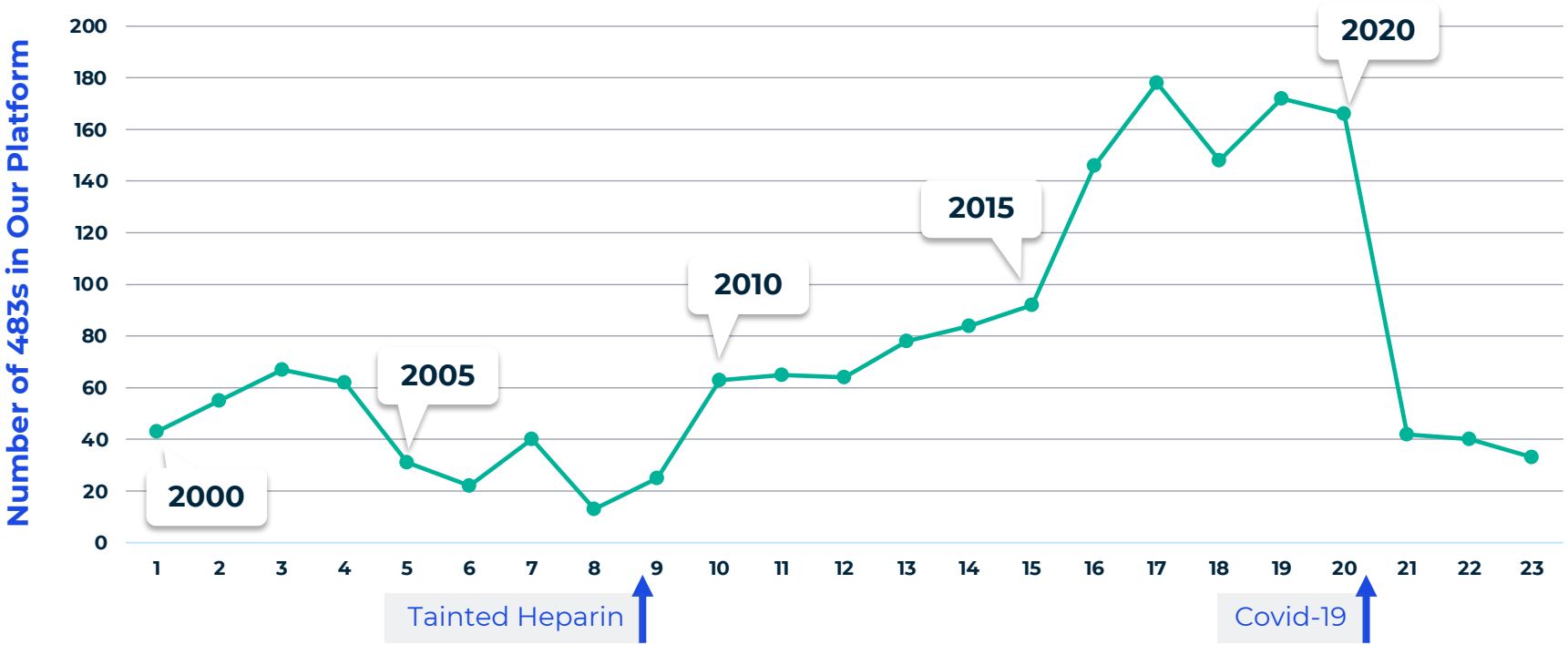
Country	# API 483s	% Total
United States	689	39.8
India	293	16.9
China	222	12.8
Japan	112	6.5
Italy	71	4.1
Germany	50	2.9
Spain	36	2.1
Great Britain	31	1.8
Switzerland	30	1.7
France	22	1.3
Korea	19	1.1
Austria	15	0.9
Israel	14	0.8
Denmark	13	0.8
Taiwan	12	0.7
26 countries	*Avg. = 3.8 Obs.*	

Country	# FDF 483s	% Total
United States	6748	74.2
India	633	7.0
China	306	3.3
Japan	176	1.9
Germany	160	1.8
Canada	136	1.5
Italy	128	1.4
Great Britain	95	1.0
France	86	0.9
Spain	67	0.7
Switzerland	63	0.7
Korea	62	0.7
Ireland	45	0.5
Taiwan	34	0.4
Austria	34	0.4
39 countries	*Avg. = 8.3 Obs.*	

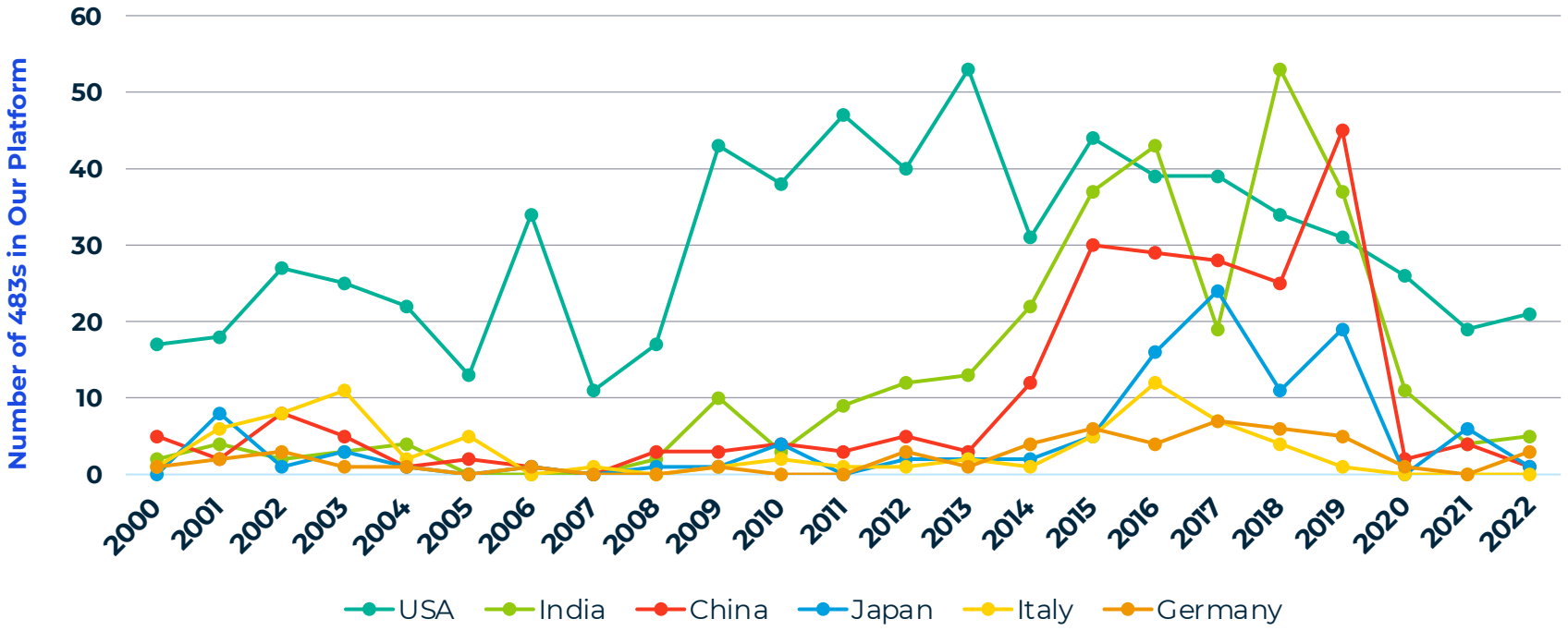
Key Takeaway:

We have more API 483s issued in the U.S. than in India and China combined; more FDF 483s globally

Total Number of API 483s in Platform From 2000 to 2022



API 483s Top 6 Countries 2000-2022



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APIs are Not Covered Under the CFR, Which Covers Drug Products

21 CFR § 210.3 (b)(4): *"Drug product means a **finished dosage form**, for example, tablet, capsule, solution, etc., that contains an active drug ingredient generally, but not necessarily, in association with inactive ingredients. The term also includes a finished dosage form that does not contain an active ingredient but is intended to be used as a placebo."*

- Cannot cite the CFR for APIs, so generally the FD&C Act is cited (high level).

For example, *"your API are adulterated within the meaning of section 501(a)(2)(B) of the Federal Food, Drug, and Cosmetic Act (FD&C Act), 21 U.S.C. 351(a)(2)(B)."*

FD&C Act 501(a)(2)(B):

“in conformity with current good manufacturing practice to assure that such drug meets the requirements of this chapter as to safety and has the identity and strength, and meets the quality and purity characteristics, which it purports or is represented to possess”

21 U.S.C. 351(a)(2)(B)

“…strength, quality, or purity differing from official compendium”

- ICH developed Q7 Guidance for Industry, “Good Manufacturing Practice Guidance for Active Pharmaceutical Ingredients”
  - Published in 2000, Revised in 2016, agreed to internationally
  - Adopted by agencies including FDA as guidance; not U.S. law
  - Q7 uses language that is concise and vetted
- 483 language vs. warning letter language

Examples of ICH Q7 and Corresponding API Warning Letter Language Mapped

ICH Q7 Language and Section	Language used in API Warning Letters	Quality System Map	Inferred 21 CFR
Computerized systems should have sufficient controls to prevent unauthorized access or changes to data. (5.43)	controls over computerized systems to prevent unauthorized access or changes to data	Data Integrity > System Controls	211.68(b)
Records of major equipment use, cleaning, sanitation, and/or sterilization and maintenance... (6.20)	Failure to...to keep complete records of major equipment maintenance.	Facilities and Equipment > Cleaning > Equipment	211.67(c)
All quality-related complaints, whether received orally or in writing, should be recorded and investigated according to a written procedure. (15.10)	Failure of your quality unit to ensure that quality-related complaints are investigated and resolved.	Quality System > Complaint Management	211.198
There should be written procedures describing the receipt, identification, quarantine, storage, handling, sampling, testing, and approval or rejection of materials. (7.10)	adequate written procedures for the receipt, identification, quarantine, storage, sampling, testing, handling, and approval or rejection of raw materials	Materials > Material Receipt and Handling > General	211.80
Buildings used in the manufacture of intermediates and APIs should be properly maintained and repaired and kept in a clean condition. (4.70)	properly maintain buildings and facilities used in the manufacture of intermediates and API	Facilities and Equipment > Maintenance > Facilities	211.58
All specifications, sampling plans, and test procedures should be scientifically sound and appropriate... (11.12)	Failure to ensure that all test procedures are scientifically sound and appropriate...	Laboratory > General Requirements > Laboratory Controls	211.160(b)

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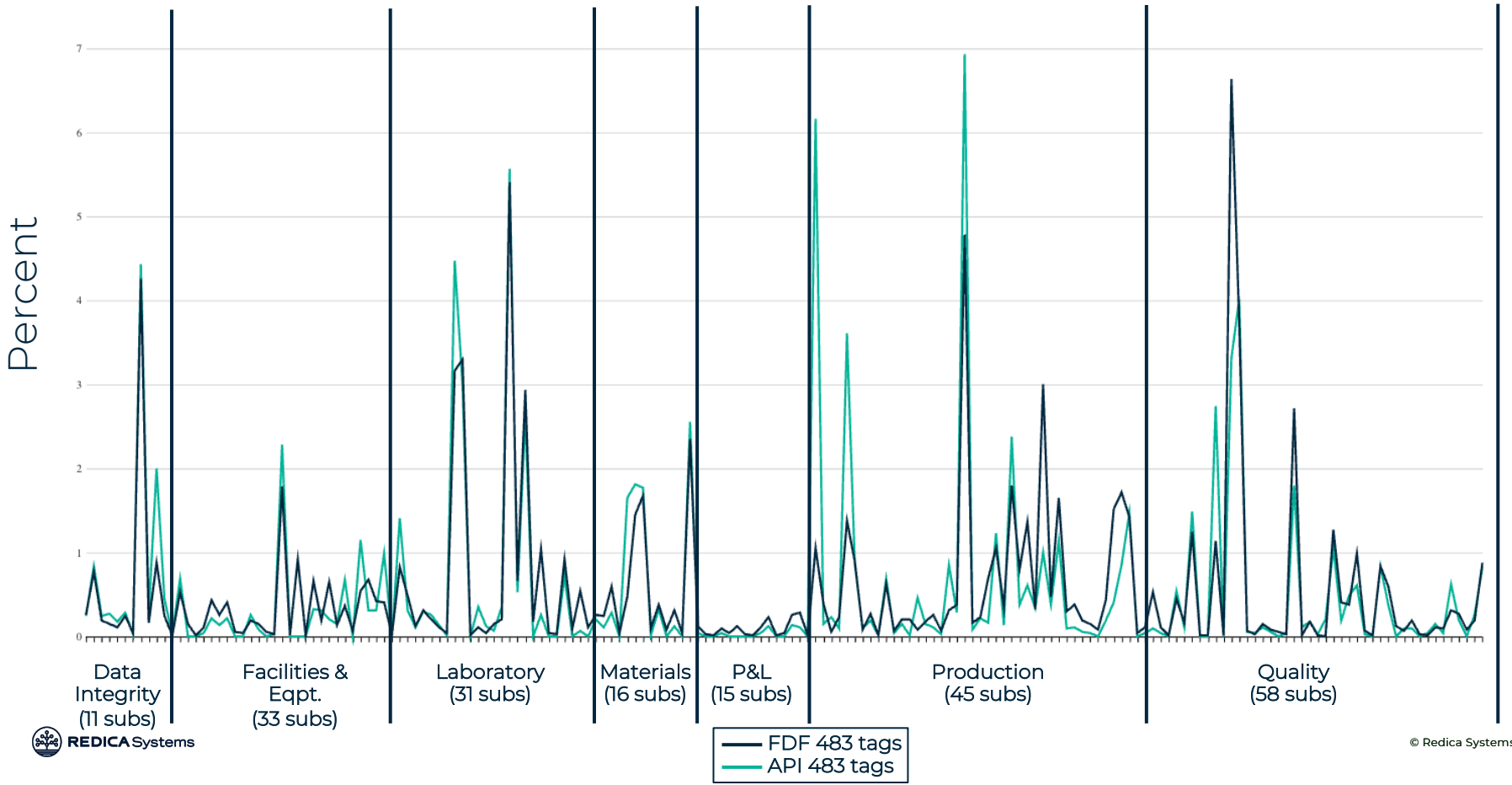
All API and FDF 483 QSL Tags 2000 – 2022 by Quality System



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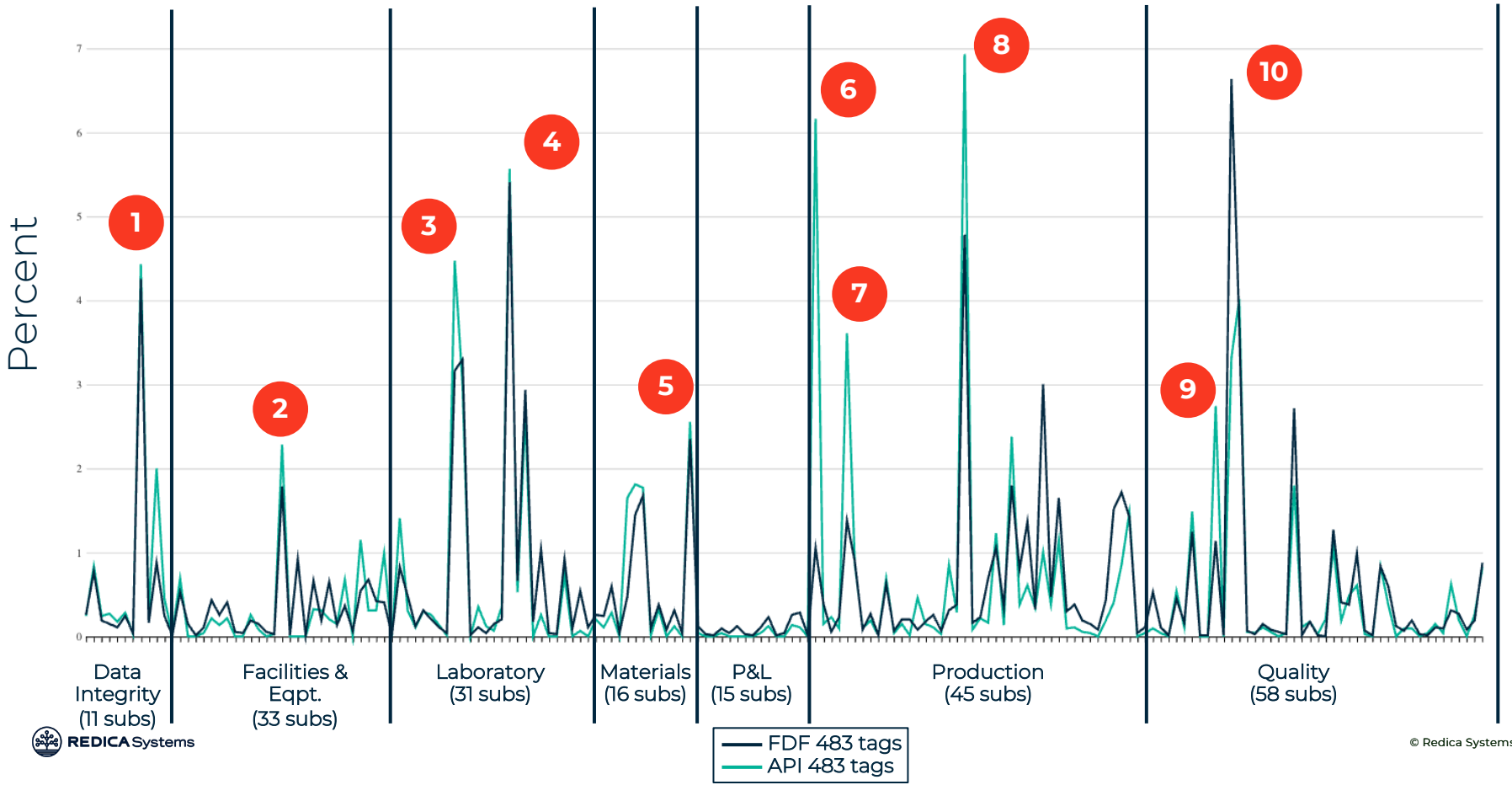

Selected Examples of Top 483 QSL Tags

2000 - 2022

1. Data Integrity > Original Data
2. Facilities & Equipment > Design > Plumbing
3. Laboratory > Stability > Stability Program
4. Laboratory > Method Validation
5. Materials > Material Storage and Control
6. Production > Batch Records
7. Production > Cleaning Validation or Verification > General
8. Production > Process Validation inadequate or missing
9. Quality > Change Control > General
10. Quality > Complaint management

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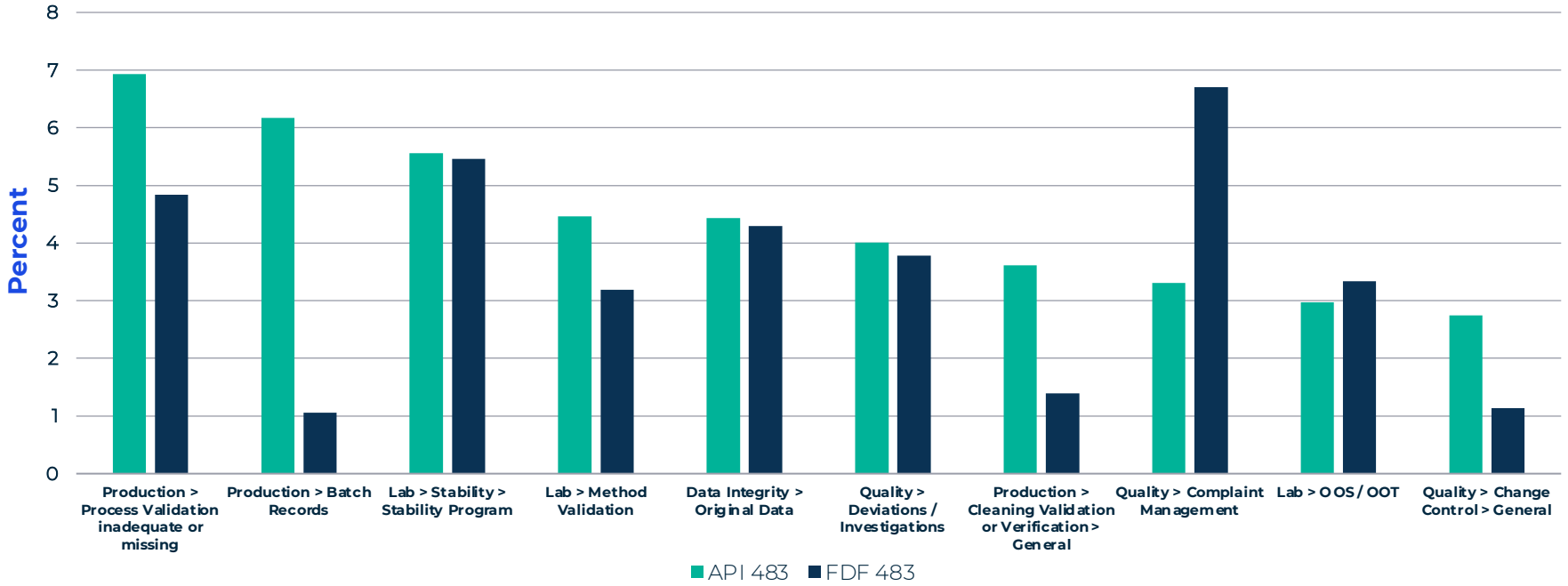
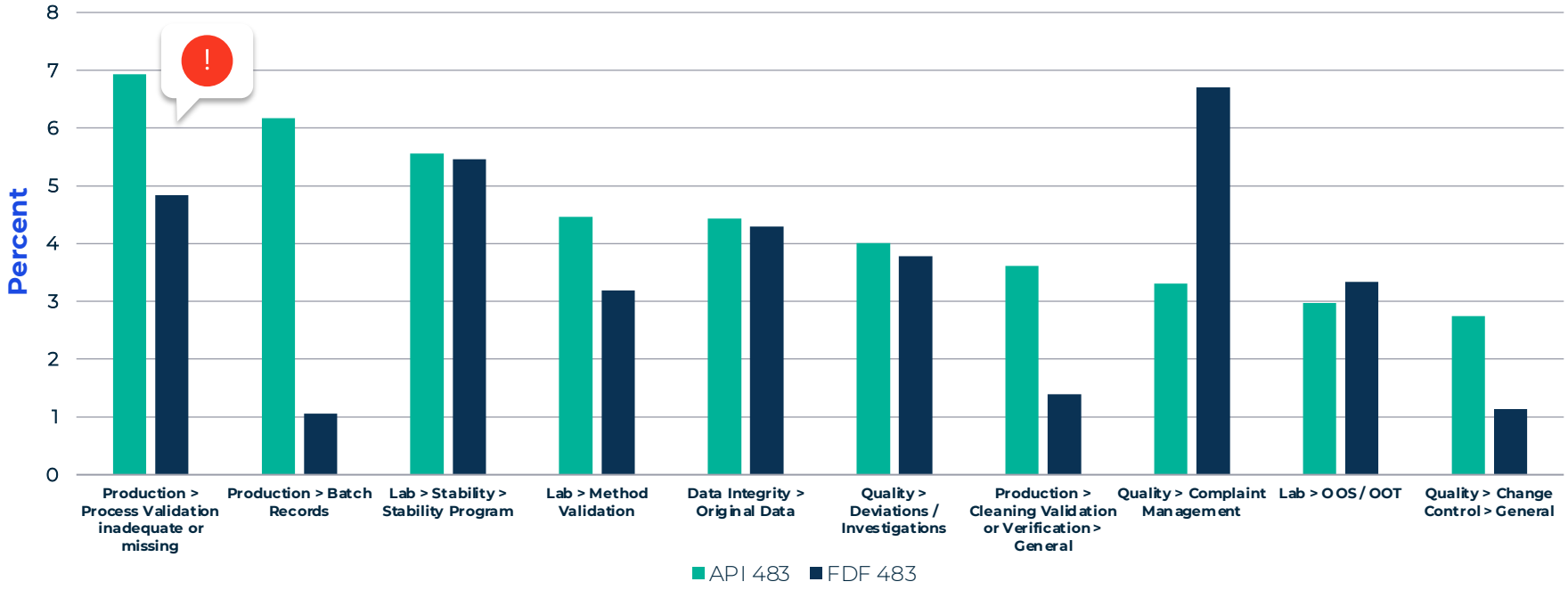
Top 10 API 483 Deficiencies in Decreasing Order Compared to FDF



Key Takeaway: Further analyze differences that make the API data set different from FDF

Top 10 API 483 Deficiencies in Decreasing Order Compared to FDF



Key Takeaway: Further analyze differences that make the API data set different from FDF

Quality System:

Production > Process Validation Inadequate or Missing

Number of Observations:

About 1/3 higher percent than FDF

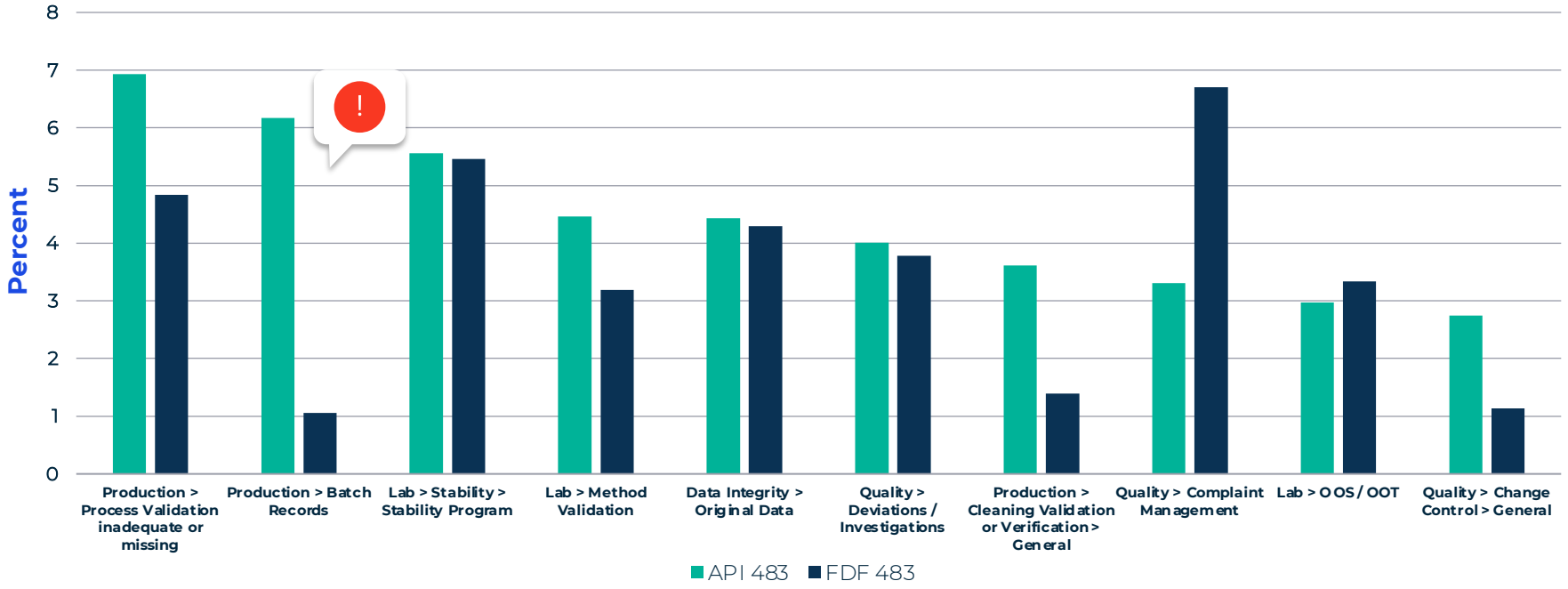
Example Observation Text:

“the data to support the prospective process validation is incomplete and does not demonstrate that the process is capable of reproducible commercial manufacture”

“you did not evaluate the effectiveness of your process validation for this newly validated process”

“the performance qualification of tank S07007 used in the purification of API is deficient”

Top 10 API 483 Deficiencies in Decreasing Order Compared to FDF



Key Takeaway: Further analyze differences that make the API data set different from FDF

Quality System:

Production > Batch Records

Number of Observations:

Nearly 6-fold higher percent than FDF

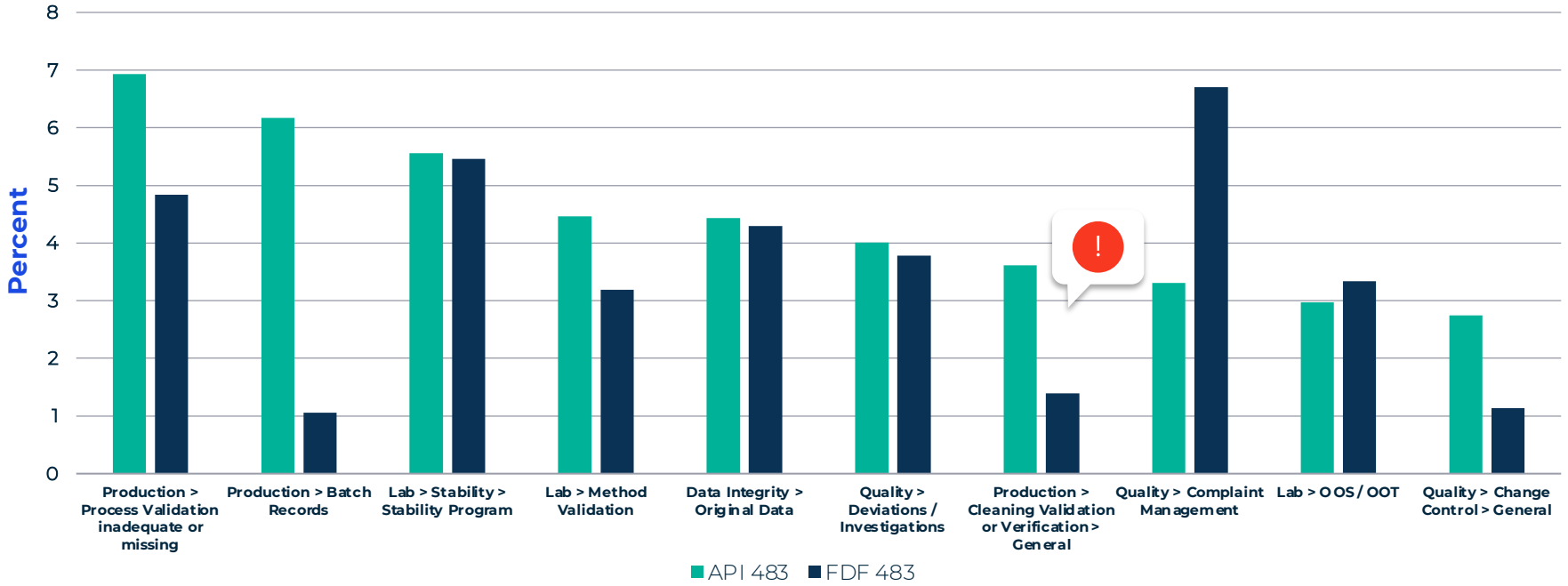
Example Observation Text:

“the quality unit lacks adequate control over the issuance of master production batch records and all QA related records purported to be controlled under your firm’s batch and CGMP issuance procedures”

“batch production and control records do not include the identification of the persons directly supervising and checking each significant step in the operation for each batch of drug product produced”

“batch production records do not include complete and accurate information of CGMP activities”

Top 10 API 483 Deficiencies in Decreasing Order Compared to FDF



Key Takeaway: Further analyze differences that make the API data set different from FDF

Quality System:

Production > Cleaning Validation or Verification

Number of Observations:

About 2/3 higher percent than FDF

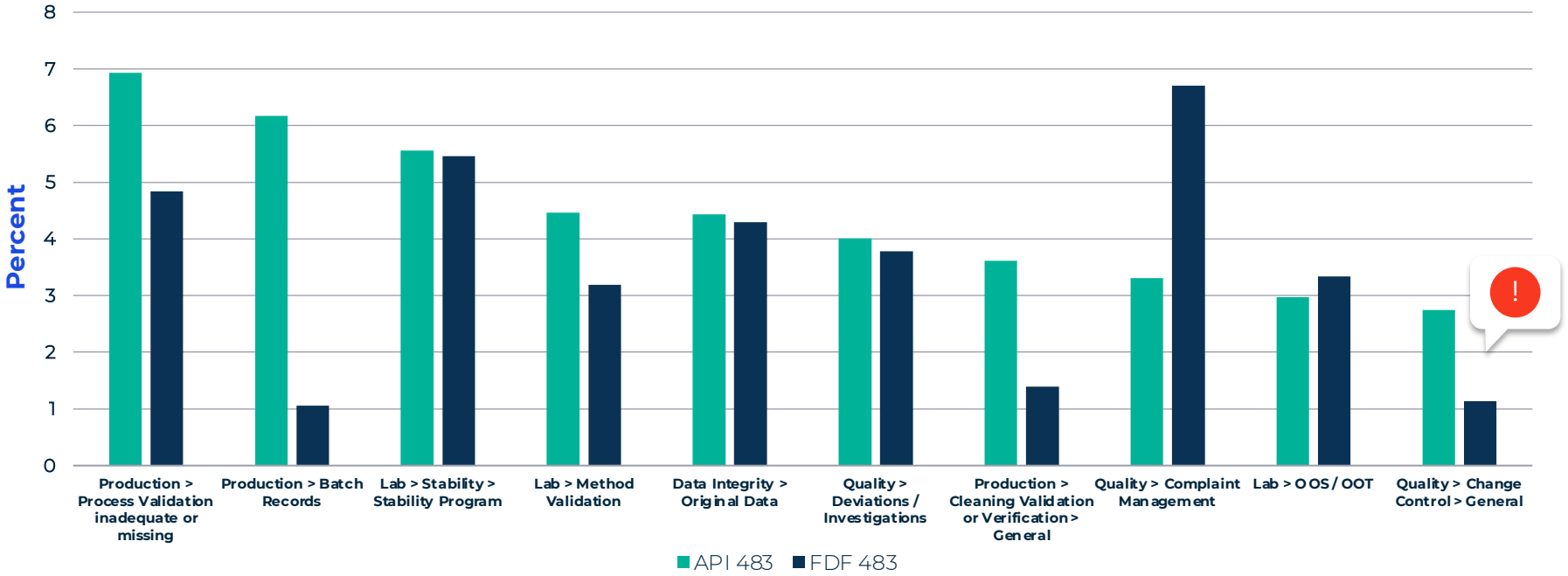
Example Observation Text:

“cleaning validation for non-dedicated manufacturing equipment has not been conducted”

“cleaning validation is not done and or extended to all non-dedicated storage receiving and tanks”

“according to the vice president quality there is no cleaning validation for (b)(4) because they are cleaned and checked visually”

Top 10 API 483 Deficiencies in Decreasing Order Compared to FDF



Key Takeaway: Further analyze differences that make the API data set different from FDF

Quality System:

Quality > Change Control > General

Number of Observations:

More than double the percent than FDF

Example Observation Text:

“the established change control procedure was not followed”

“a change in quality testing laboratories occurred and a change control was not initiated and reviewed by the quality unit”

“change control system does not cover stability changes such as methods specifications or testing points”

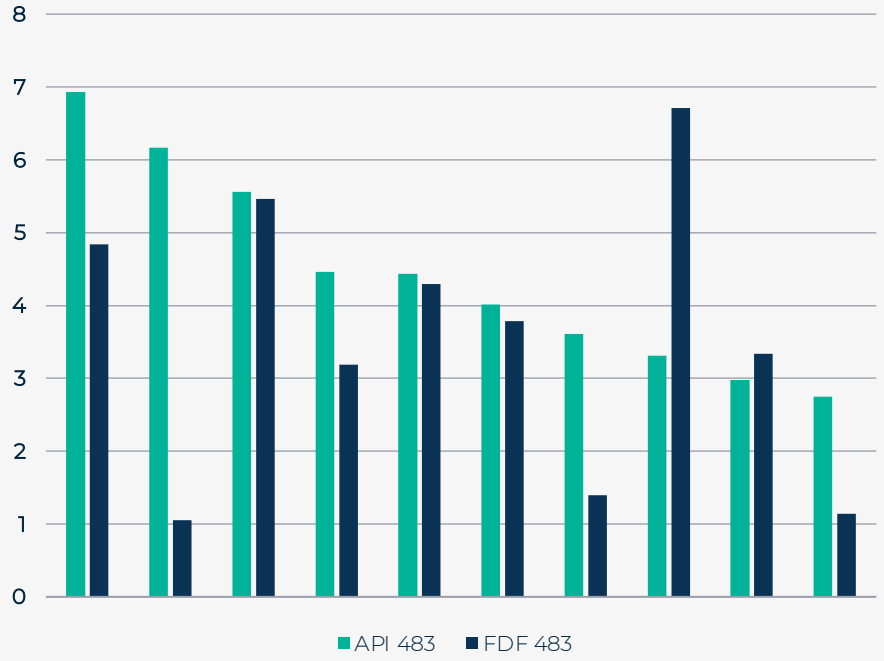
“the change control did not require the production records be revised”

Agenda

- Introduction
- Data Sources and QSL Models
- The Global 483 Landscape
- How API Regulation Differs – ICH Q7
- API 483s vs. FDF 483s and Some Insights
- Some Specific 483 Observations
- Conclusions

Conclusions

- Identifying API 483s is challenging
- ICH Q7 standard is internationally recognized
- FDA cannot cite it directly because it is not U.S. law, but uses it as a guide
- Many issues are the same API and FDF manufacturing, but with some nuances
- There are areas in API manufacturing that need more attention, specifically in the Production System
- Use this analysis to know where to focus API inspections, including of suppliers / partners for due diligence



Post Presentation Note:

- We are just finishing up a series of three-minute videos those of you interested in analysis of Finished Dosage Form drug inspections will be interested in.

- Each three-minute video focuses on one of the 6+1 quality systems and goes into detail on the top three inspection findings for that system.

- You can see them on our YouTube channel **at this link**.

- We are considering doing a similar analysis that would focus instead on API 483s. If this would be of interest to you, please let us know.

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