ClearPath RD

clearpathrd.com

Lab Partner Integration Specification

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Purpose of this document

A lab partner has not yet been selected. This document serves two purposes: (1) it defines what ClearPath RD needs from a lab partner so those requirements can be evaluated before signing an agreement, and (2) it specifies how each possible integration model would be implemented technically, so development can proceed in parallel with partner negotiations.

What this document covers

- What ClearPath RD needs from a lab partner — a requirements checklist for partner evaluation
- Four integration models — API, structured email, file-based, and manual portal
- Order transmission specification — the canonical order payload regardless of transport
- Kit serial number assignment — how serials are generated and when they are assigned
- Result delivery paths — all three paths (lab-to-user, lab-to-ClearPath, user self-entry) and how the system handles each
- Canonical result format — the data ClearPath RD needs to create a Result record
- Lab order reference tracking — how lab_order_reference is used in kit_orders
- Return envelope and mailing logistics
- Integration model decision record — to be completed when a partner is selected
- Partner evaluation scorecard and due diligence questions

1. What ClearPath RD Needs From a Lab Partner

Before selecting a lab partner, these requirements must be confirmed. This list is the basis for partner evaluation conversations.

1.1 Non-Negotiable Requirements

> *A lab that cannot meet all non-negotiable requirements cannot be used as a partner for ClearPath RD, regardless of price.*

	Requirement	Why it matters
✓	**Alpha track (CR-39) long-term detection**	ClearPath RD sells 91-day long-term tests. The lab must support this methodology.
✓	**Short-term detection (48–96 hours)**	Required for the real_estate_short kit type.
✓	**Results reported in Bq/m³**	Health Canada guideline is in Bq/m³. Results in pCi/L create conversion ambiguity and user confusion.
✓	**C-NRPP or equivalent accreditation**	Certificates must reference an accredited measurement methodology to be credible to insurers and real estate professionals.
✓	**Unique serial number per detector**	ClearPath tracks each kit by kit_serial_number. The lab must either pre-assign serials or accept ClearPath-assigned serials.
✓	**Turnaround time ≤ 4 weeks from receipt**	The results_prompt email fires 10 days after mailing. A 4-week maximum allows reasonable follow-up timing.
✓	**Result delivery to ClearPath or user by email**	At minimum, an email with the result value. Required for the user self-entry path.
✓	**Canadian shipping address for returns**	User mails kit to a Canadian address. International returns are not acceptable for MVP.
✓	**Ability to handle ClearPath-branded return packaging**	ClearPath return envelopes must be accepted by the lab without requiring separate registration.

1.2 Strongly Preferred Requirements

These are not blockers but will significantly reduce integration complexity and operational burden:

- REST API for order submission — eliminates manual order entry and enables automated fulfilment
- Webhook or API for result delivery — enables automated result entry and eliminates the user self-entry step
- Ability to accept ClearPath-assigned kit serial numbers — simplifies serial tracking
- Online portal for order status tracking — enables admin visibility without API integration
- Bulk pricing at volume thresholds — important for margin as order volume grows
- Dedicated account contact — for issue resolution and API support

1.3 Nice-to-Have

- White-label result reports (PDF) — would allow ClearPath to offer a lab report download in addition to the ClearPath certificate
- Digital chain-of-custody records — useful for legal disputes or insurance claims

- LIMS (Laboratory Information Management System) integration — for high-volume automation

2. Integration Model Options

Four integration models are possible depending on what the lab partner supports. All four are specified in full. The decision of which to implement is recorded in Section 8 once a partner is selected.

Model	Order transmission	Result delivery	Dev effort	Recommended?
Model A REST API	POST order to lab API endpoint	Webhook or polling from lab API	Low — clean integration	**Yes, if available**
Model B Structured email	Formatted email sent to lab address	Lab emails result to ClearPath or user	Medium — parse inbound email	**Acceptable for MVP**
Model C File / SFTP	CSV batch file sent to lab SFTP	Lab returns CSV result file	Medium — file watcher or scheduled pull	**Acceptable for MVP**
Model D Manual / web portal	Admin enters order in lab portal manually	Lab emails result directly to user	High (human) — no automation	**Last resort only**

> *Implementation recommendation: build the system with an abstraction layer (LabService interface) so the integration model can be swapped without touching route handlers or business logic. The interface has two methods: submitOrder(order) and (optionally) getResult(labReference). The concrete implementation behind the interface changes per model.*

3. Canonical Order Payload

Regardless of transport (API, email, CSV), ClearPath sends the same logical set of fields to the lab for every order. The transport layer formats these fields appropriately.

3.1 Order Fields

Field	Type	Description
clearpath_order_id	string (UUID)	The kit_orders.id UUID. Used to match the lab's response back to a ClearPath order.
kit_type	string enum	long_term or real_estate_short. Tells the lab which detector type to fulfil.
quantity	integer	Number of kits in this order. 1 for standard_long and real_estate_short; 2 for twin_pack.
kit_serials	string[]	Array of kit serial numbers assigned to this order. See Section 4 for serial assignment.
shipping_name	string	Recipient full name (users.first_name + last_name).
shipping_address_line1	string	Street address from kit_orders.shipping_address_line1.
shipping_city	string	City.
shipping_province	string	Two-letter province code.
shipping_postal_code	string	Postal code.
shipping_phone	string|null	Optional. From users.phone. Useful for courier notifications.
order_date	string (ISO date)	Date the order was paid. kit_orders.paid_at date part.
result_delivery_email	string	Email address for result delivery. See Section 5 for options.
notes	string|null	Optional. Admin-entered notes for special handling (e.g., expedited processing).

3.2 JSON Representation (Model A — REST API)

```
{
  "clearpath_order_id": "a1b2c3d4-...",
  "kit_type": "long_term",
  "quantity": 1,
  "kit_serials": ["CPR-2026-000142"],
  "shipping_name": "Jane Smith",
  "shipping_address_line1": "123 Elm Street",
  "shipping_city": "Calgary",
  "shipping_province": "AB",
  "shipping_postal_code": "T2J 4K9",
  "shipping_phone": "+14035550100",
  "order_date": "2026-03-01",
  "result_delivery_email": "results@clearpathrd.com",
  "notes": null
}
```

3.3 CSV Representation (Model C — File-Based)

For file-based integration, each order is one row. Twin pack orders produce two rows (one per serial). Column order is fixed and agreed with the lab partner.

```
clearpath_order_id,kit_type,serial,shipping_name,address_line1,city,province,postal,phone,order_date,result_email
a1b2c3d4-...,long_term,CPR-2026-000142,Jane Smith,123 Elm St,Calgary,AB,T2J 4K9,+14035550100,2026-03-01,results@clearpathrd.com
```

3.4 Structured Email (Model B)

For email-based integration, orders are sent as a formatted plain-text email to a designated lab address. The subject line format is fixed: "ClearPath RD Order — [clearpath_order_id]". The body contains the canonical fields in a fixed key: value format that the lab can parse or transcribe manually.

4. Kit Serial Number Assignment

4.1 Serial Format

ClearPath assigns its own serial numbers to all kits. The serial number is pre-assigned at order creation and included in the order payload to the lab. The lab ships the detector with this serial number written on or attached to the detector.

Property	Specification
Format	CPR-YYYY-NNNNNN where YYYY is the order year and NNNNNN is a zero-padded 6-digit sequential integer.
Example	CPR-2026-000142
Uniqueness	Unique constraint enforced on test_sessions.kit_serial_number in the database.
Generation	Sequential. Same pattern as certificate numbers. Generated in a transaction to prevent duplicates.
When assigned	At order creation time (when the KitOrder record is created, before payment confirmation). Reserved serials for failed payments are recycled after 24 hours.
Twin pack	Two serials generated per twin_pack order. Both included in the kit_serials array in the order payload.

4.2 If the Lab Assigns Its Own Serials

Some labs assign their own internal serial or batch numbers to detectors. In that case:

- ClearPath still generates its own serial (CPR-YYYY-NNNNNN) for internal tracking.
- The lab's serial is stored as lab_order_reference on the KitOrder record.
- The activation flow asks the user to confirm the serial number on the physical detector. If the lab's serial is on the detector rather than ClearPath's, the activation form must accept either format and map to the ClearPath serial.
- This mapping (lab serial → ClearPath serial) is maintained in the kit_orders table via lab_order_reference.

5. Result Delivery Paths

There are three paths by which a result can reach the ClearPath RD system. All three must be supported. The system cannot depend on only one path because different labs use different processes, and some users will receive results directly even if the lab also notifies ClearPath.

> *All three paths converge at the same endpoint: a Result record is created in the database with value_bqm3, zone (derived), lab_reference, and recorded_at. Certificate generation fires regardless of which path was used.*

5.1 Path A — User Self-Entry

The user receives their result from the lab (by email, portal, or physical report) and enters it in the ClearPath app via the result entry screen. This is the minimum viable path and works with any lab regardless of integration model.

Property	Specification
User action	Navigate to session detail → "Enter result" → type the Bq/m³ value → submit
API endpoint	POST /api/v1/sessions/:sessionId/result
Required fields	value_bqm3 (number), recorded_at (timestamp)
Optional fields	lab_reference (string) — user can optionally enter the lab's reference number
Zone derivation	Server-side. Client never submits zone.
Validation	value_bqm3 must be >= 0. Session must be in mailed or results_pending status.
Unit handling	Result entry UI accepts Bq/m³ only. If the user has a pCi/L result, the UI provides a conversion helper (multiply by 37). The stored value is always Bq/m³.
Prompt	The results_prompt email (EMAIL-7) drives the user to this screen 10 days after mailing.

5.2 Path B — Lab Emails Result to ClearPath

The lab sends the result to a ClearPath-controlled inbox (results@clearpathrd.com). ClearPath processes the inbound email and either enters the result automatically (if parseable) or routes it to an admin for manual entry.

Property	Specification
Result email address	results@clearpathrd.com. This address is included in the result_delivery_email field of every order payload.
Inbound email processing	For MVP: admin monitors results@clearpathrd.com and enters results manually via the admin dashboard. Automated parsing is a v2 enhancement.
Required result content	The lab email must contain: the kit serial number (or ClearPath order ID), the Bq/m³ value, and the measurement date. Plain text or PDF attachment both acceptable.
Admin entry flow	Admin locates the session by serial number or order ID in the admin dashboard → enters the result value → system generates certificate automatically.
Automation path (v2)	Inbound email parsing via a webhook from the email provider (e.g., Resend

	inbound, Mailgun routes, or Postmark inbound). Parse for serial number and Bq/m³ value → auto-create Result record.

5.3 Path C — Lab API Delivers Result (Model A only)

If the lab has a REST API, ClearPath can either poll for results or receive them via webhook. This is the most automated path and eliminates both manual admin entry and dependence on user action.

Property	Specification
Polling approach	ClearPath scheduled job calls lab API every 24 hours: GET /results?since={last_checked}. Lab returns results for ClearPath orders. System matches by clearpath_order_id or kit serial and auto-creates Result records.
Webhook approach	Lab sends a POST to a ClearPath webhook endpoint when a result is ready. ClearPath verifies the request (shared secret in header), extracts the result, and creates the Result record.
Webhook endpoint (if implemented)	POST /api/v1/webhooks/lab. Shared secret verified via X-Lab-Secret header. Payload: canonical result format (Section 6).
Preferred approach	Webhook preferred over polling — lower latency, no unnecessary API calls. Use polling as fallback if the lab does not support webhooks.
Duplicate handling	Before creating a Result record from an automated delivery, check if a result already exists for the session. If so, log the duplicate and skip. Do not overwrite user-entered results.

6. Canonical Result Format

Whether the result comes from user entry (Path A), admin entry after a lab email (Path B), or automated lab API (Path C), the same Result record is created in the database. This is the canonical format.

Field	Type	Description
`kit_serial`	string	The kit serial number (CPR-YYYY-NNNNNN). Used to look up the test_session_id.
`clearpath_order_id`	string (UUID)	Alternative lookup key if serial is unavailable. kit_orders.id.
`value_bqm3`	decimal	The radon concentration in Bq/m³. Must be >= 0. Maximum reasonable value: ~10,000 Bq/m³.
`lab_reference`	string|null	The lab's internal reference number for this sample. Stored for audit purposes. Not shown to the user.
`recorded_at`	ISO 8601 timestamp	When the measurement was recorded by the lab. Used as the certificate's valid_from date basis.
`source`	string enum	self_entry | lab_email | lab_api. Not stored in DB but logged for diagnostics.

6.1 Zone Derivation

Zone is always derived server-side from value_bqm3. It is never accepted from an external source.

Zone	Condition
below_guideline	value_bqm3 < 100
caution	100 ≤ value_bqm3 < 200
action_required	200 ≤ value_bqm3 < 600
urgent_action	value_bqm3 ≥ 600

6.2 Unit Handling

All results are stored in Bq/m³. If a lab delivers results in pCi/L, conversion must happen before creating the Result record.

```
value_bqm3 = value_pCiL * 37.0
```

The conversion factor is 37.0 exactly (1 pCi/L = 37 Bq/m³ by definition). Store the Bq/m³ value. Do not store the pCi/L value. If the lab delivers in pCi/L, note this in the lab_reference field for audit purposes.

7. Return Envelope and Mailing Logistics

7.1 Prepaid Return Envelope

Each kit shipped to a customer must include a prepaid Canada Post return envelope addressed to the lab. ClearPath is responsible for sourcing these envelopes. The lab provides the return address; ClearPath pre-pays and pre-addresses them at fulfilment time.

Property	Specification
Envelope source	ClearPath orders prepaid return envelopes from Canada Post in bulk and ships them to the lab for inclusion with detector kits.
Addressing	Pre-addressed to the lab's Canadian return address.
Postage	Pre-paid by ClearPath at envelope creation time. Canada Post Lettermail or Expedited Parcel depending on detector weight.
Inclusion responsibility	The lab includes one return envelope per detector in each outbound kit shipment.
Lost envelope handling	If a user reports a lost return envelope, admin can email a replacement address label or instruct the user to use a plain envelope with the lab address. The lab address must be available as a static config value in the API (LAB_RETURN_ADDRESS env var).
MVP simplification	For MVP, ClearPath may instruct the lab to include a printed return address card instead of a prepaid envelope, and reimburse users for Canada Post costs. Confirm with lab partner.

7.2 Outbound Fulfilment

Outbound fulfilment (shipping detectors to customers) is the lab's responsibility. ClearPath submits the order with a shipping address; the lab picks, packs, and ships.

Property	Specification
Shipping carrier	Lab's choice. Must be a tracked Canadian carrier (Canada Post, Purolator, UPS, FedEx).
Tracking	If the lab provides a tracking number via API or email, store it in kit_orders.lab_order_reference or a separate tracking field. For MVP, tracking is optional.
Estimated delivery	ClearPath shows customers "5–7 business days" as a static estimate in the order_confirm email. Confirm this is accurate with the lab partner.
Undeliverable packages	If a kit is returned to the lab as undeliverable, the lab notifies ClearPath (results@clearpathrd.com). Admin updates the shipping address and requests re-shipment.

8. System Integration Architecture

8.1 LabService Interface

All lab integration logic is encapsulated in src/services/lab.ts. Route handlers and webhook handlers call this service; they do not implement lab-specific logic directly. This allows the integration model to be changed by swapping the concrete implementation.

```
// src/services/lab.ts
interface LabService {
  submitOrder(order: LabOrder): Promise<{ labReference: string | null }>;
  getResult?(labReference: string): Promise<LabResult | null>; // optional, Model A
only
}
```

```
// Concrete implementations:
// - LabServiceAPI      — Model A: REST API
// - LabServiceEmail    — Model B: sends structured email via Resend
// - LabServiceFile     — Model C: writes CSV to SFTP or email attachment
// - LabServiceManual   — Model D: no-op, logs order for manual processing
```

The active implementation is selected by the LAB_INTEGRATION_MODEL environment variable (api | email | file | manual). Default for MVP: manual or email.

8.2 Order Submission Trigger

Lab order submission is triggered by the Stripe payment_intent.succeeded webhook handler, after the KitOrder and TestSession records are created. The flow:

- 1. Stripe webhook fires → Fastify verifies signature
- 2. KitOrder.payment_status set to paid
- 3. TestSession record(s) created with status = ordered
- 4. labService.submitOrder(order) called — result stored in kit_orders.lab_order_reference
- 5. order_confirm email sent via Resend

If labService.submitOrder() fails, the error is logged and an admin alert is triggered. The order and session records are NOT rolled back — the customer has paid and the session exists. Admin can retry the lab submission manually from the admin dashboard.

8.3 Environment Variables

Property	Specification
LAB_INTEGRATION_MODEL	api | email | file | manual. Selects the LabService implementation.
LAB_API_BASE_URL	Base URL of the lab REST API (Model A only). e.g. https://api.labpartner.ca/v1
LAB_API_KEY	API key for authenticating with the lab REST API (Model A only).
LAB_WEBHOOK_SECRET	Shared secret for verifying inbound lab webhooks (Model A — webhook path only).

LAB_ORDER_EMAIL	Lab email address for order submission (Model B). e.g. orders@labpartner.ca
LAB_SFTP_HOST	SFTP host for file-based integration (Model C).
LAB_SFTP_USER	SFTP username (Model C).
LAB_SFTP_KEY	SFTP private key (Model C, stored as env var, not a file).
LAB_RETURN_ADDRESS	Lab mailing address for return envelopes. Static string. Used in emails and PDF.
LAB_RESULT_EMAIL	ClearPath inbox for receiving lab results (all models). results@clearpathrd.com

9. Integration Model Decision Record

This section is intentionally blank. It is to be completed when a lab partner is selected and their integration capabilities are confirmed. Copy this document, fill in the fields below, and store as ClearPathRD_LabIntegration_v1.1.docx.

Property	Specification
Lab partner name	[To be completed]
Lab partner contact	[Name, email, phone]
C-NRPP / accreditation number	[To be confirmed]
Integration model selected	[A / B / C / D]
Order transmission method	[To be confirmed with lab]
Result delivery method	[To be confirmed with lab]
Serial number approach	[ClearPath-assigned / Lab-assigned with mapping]
Result unit	[Bq/m³ / pCi/L — if pCi/L, confirm conversion is handled]
Turnaround time confirmed	[e.g. 14 days from receipt]
Canadian return address	[Lab mailing address for LAB_RETURN_ADDRESS env var]
Pricing agreed	[Per-unit cost, volume thresholds]
Agreement signed date	[Date]
Integration live date	[Target date]
Decision made by	[Name]

10. Partner Evaluation Scorecard

Use this scorecard when evaluating candidate lab partners. Score each criterion 1–3. Total score out of 36. Partners scoring below 24 should not be selected.

Criterion	1 — Poor	2 — Acceptable	3 — Excellent
Accreditation (C-NRPP or equivalent)	No accreditation	In process	Fully accredited
Turnaround time	> 6 weeks	3–6 weeks	< 3 weeks
Result delivery method	Manual only (fax/call)	Email with structured data	API or webhook
Order submission method	Manual portal only	Structured email accepted	REST API available
Results in Bq/m³ natively	pCi/L only, no conversion	pCi/L with conversion service	Bq/m³ native
Canadian return address	US address only	Canadian address, slow processing	Canadian address, fast processing
Serial number flexibility	Lab assigns, no override	Lab assigns, mapping possible	Accepts ClearPath serials
Support responsiveness	> 48hr response	24–48hr response	< 24hr response
Volume pricing	No discounts	Discounts at high volume	Discounts at ClearPath MVP volume
White-label capability	Not available	Partial (letterhead only)	Full white-label reports
Online order tracking	Not available	Basic status (shipped/received)	Full tracking with timestamps
References / track record	New lab, no references	Some references, mixed reviews	Established, strong references

10.1 Due Diligence Questions

Ask every candidate lab partner these questions before selecting them:

- What accreditation do you hold? Is it current? Can you provide your certificate number?
- What is your typical turnaround time from sample receipt to result delivery?
- Do you have a REST API for order submission? Is there documentation available?
- How do you deliver results — email, portal, API, or some combination?
- Do you deliver results in Bq/m³ or pCi/L?
- Can you accept kit serial numbers we pre-assign, or do you assign your own?
- What is your Canadian mailing address for sample returns?
- Can you include a prepaid return envelope in each outbound shipment?
- What volume can you process per month? Are there seasonal capacity constraints?
- What is your per-unit pricing? Are there volume discounts?
- Can you provide contact information for 2–3 current customers as references?
- What happens if a sample is lost in transit or cannot be analysed?
- What is your quality control process for anomalous results (e.g., > 2,000 Bq/m³)?

— End of Lab Partner Integration Specification —

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