VARSKIN+ 2.1
Software Release Note

April 2025

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Revision History

Revision	Description
0	Initial release.
1	Added changes relevant from version 2.0 to 2.1.

Table of Contents

1.0 Introduction

This document outlines in detail the modifications, additions, and/or removal of features from VARSKIN+ v1.3.1 to VARSKIN+ v2.1.

The change associated with version 2.0 of VARSKIN+ is to add the new Extravasation Dosimetry model. Version 2.1 incorporates a correction within ExtravDose to handle regional formats that use commas as a separator versus decimals. No other changes were made to the other modules of VARSKIN+.

All modifications are based on items entered in the RCD software issue tracker as a source for the basis of a change.

2.0 Abbreviations and Definitions

Table 2-1. Abbreviations and definitions.

Term	Definition
CP	change package number (gitlab version identifier)
DLL	dynamic-link library
GUI	graphical user interface

3.0 Base Line Code

The changes identified here have been incorporated into the baseline of VARSKIN+ 2.1. Table 3-1 and Table 3-1 document the attributes of the software product with project dependencies as identified in Table 3-3.

Table 3-1. GIT attributes.

Git Location	Revision ID (Commit SHA)
https://gitlab.com/RCD-1/varskin/-/tags/varskin+v1.1	d2f7c94e0b144f9830f151307078c27f68d63a6e
https://gitlab.com/RCD-1/varskin/-/tags/varskin+v1.2	2295b4ef6963f161fdfa91868ded5419ff602121
https://gitlab.com/RCD-1/varskin/-/tags/varskin+v1.3	137adac8cb4c6ade81d4eb9c70018eeaa7c69fe2
https://gitlab.com/RCD-1/varskin/-/tags/varskin+v1.3.1	777ed573c8841bb9c7fa272cda3e50eab253314c
https://gitlab.com/RCD-1/varskin/-/tags/varskin+v2.0	fefe81be88d14adb393776fc8ddbd5084991d374
https://gitlab.com/RCD-1/varskin/-/tags/varskin+v2.1	2e67b203e80dcf7511890225d9ad4949cf0320ed

Table 3-2. Executable attributes.

Executable Name	V+2.1.exe
MD5sum	1586079507a8bcfb91bacfab4fabafc2
SHA256	460dc552436f6a9493a6d9056c77bacdddcf4678227fc950c88f96c7eb03165b
SHA512	cd97e4dc294bab4885f94fca79646adbc7c82d2446a86d0d0e63fb22f921c8873ca552d4da8a33b65ab8e5a538648b566613d2160638d756ab081f51907dee25

Table 3-3. Dependency attributes.

Software	Version	Git Location / Group ID	Revision ID (Commit SHA)
NRC-Graphing	1.0	https://gitlab.com/RCD-1/nrc-graphing/-/tags/nrcGraphing_v1.0	575af944ddf229c6ba033b4117f90d84117c9f49
RadToolbox	3.0.1	https://gitlab.com/RCD-1/radtoolbox/-/tags/radToolbox_V+v1.3.1	499592ffb31a96862df73d26b00a0d9bad3c46bd
ExtravDose	1.0.3	https://gitlab.com/RCD-1/extrav/-/tags/v1.0.3	683c1dda3e8b6d7c7daeba3ec890ac084d617a13
KeyGen	1.0	https://gitlab.com/RCD-1/keygen/-/tags/v1.0	270a0ccb47ca1149e41332af6ace3f92940a114f
files	2.0.0	https://gitlab.com/RCD-1/utilitiesjava/-/tags/utilities_v2.1	811154257793e35d4eb8ff26c29ec9dbb66b2086
formats	2.0.1		
language	2.0.0		
maths	2.0.0		
ui	1.0.0		
JFreeChart	1.5.4	org.jfree	n/a
Intel® Fortran Compiler Classic	2021.11.0	n/a	n/a
JDK	21	n/a	n/a

4.0 Changes

The following sub-sections outline the changes made from VARSKIN+ version 1.3.1 to VARSKIN+ version 2.1. A summary of changes is provided in Table 4-1 and in the following sections as needed.

Table 4-1. Summary of V+ versions and resolved issues.

Version	Issue #	Description	Section(s)/ Table(s)
1.3.1 (CP55)	99	Major Release.	-
2.0 (CP55,56)	108	Major Release. Addition of Extravasation Dosimetry model.	Section 4.1
2.1 (CP57)	128 129	Major Release. Updates to ExtravDose module.	Table 4-2.

Table 4-2. Summary of ExtravDose versions and resolved issues.

Version	Issue #	Description	Section(s)/ Table(s)
1.0.0 (CP1)	108	Major Release.	Section 4.1
1.0.1 (CP3)	128	Correction within ExtravDose to handle regional formats that use commas as a separator versus decimals in numbers.	-
1.0.2 (CP2)	130	Improved window resizing when switching between screens with different resolutions.	-

4.1. Issue 108: Addition of Extravasation Dosimetry Module

Extravasation Dose (ed.) is a module in VARSKIN+ (V+) added to version 2.0 for calculating local tissue dose from radiopharmaceutical extravasation during medical administration. Extravasation occurs when a radiopharmaceutical intended for the bloodstream leaks into surrounding tissue. It is a temporary condition in which radioactive material within the patient irradiates tissues near the site of administration for longer periods of time than if extravasation did not occur.

The developed extravasation dosimetry module is a time-dependent, multi-dimensional, and multi-physics code that breaks the region into mesh/voxel volumes for analysis. It simulates the injection of a fluid with a defined activity concentration that is then transported throughout a region while accounting for mixing (i.e., concentration changes). With the transport of the concentrated fluid, a subsequent calculation of the spatial dependent dose rates and accumulated doses to tissue resulting from the fluid transport is determined. Models have been developed with the goal of focusing on ease of use for the end user in terms of the minimal number of required inputs while ensuring a reliable solution is obtained to help inform the decision-making process.

The fluid flow model is written generically to account for the various mechanisms and forces that impact the net flow spatially (e.g., diffusion, advection, gravity, etc.). With time-dependent numeric solutions comes limitations on the size of the time steps taken while “marching” toward the end of the problem. This control has been handled internally by the model to ensure appropriate time steps are taken for the rate of change of the physical processes occurring.

The dose model accounts for doses received from alpha particles, electrons, and photons. The model considers dose to source and target voxels in the modeled region of interest (ROI). Dose rates for each time step are calculated in addition to accumulated dose for the analysis time-period.

Users have two levels of input options depending on needs. Users can perform:

- quick approximations based on a minimal set of basic inputs (Basic mode) or
- in-depth assessments utilizing advanced modeling features with an expanded set of input parameters (Advanced mode).