

Project Description

ENABLING GRADUATE LEARNING IN RISK ANALYSIS WITH EMPHASIS ON FOOD, AGRICULTURE AND VETERINARY MEDICINE

(A) Potential for Advancing the Quality of Education; Significance of the Problem:

We propose here the development of integrated curricula to enable graduate learning in science-based risk analysis and decision-making pertaining to food, agriculture, and veterinary medicine. Our longer-term goals are to develop and adapt curricula and related materials leading to the establishment of a graduate certificate and a graduate minor in Risk Analysis and Decision-Making (RA&DM) at Iowa State University. Risk analysis offerings within multidisciplinary certificate and minor programs will equip students to meet challenges in domestic or international food and agricultural markets and to deal with public concerns regarding food safety and security. The coursework we envision will enable graduate certification or a graduate minor as a means to better prepare students in science-based disciplines. This coursework will be relevant to students who pursue research and non-research careers in education, industry, government, or non-government organizations by providing the tools and approaches necessary to effectively deal with risk from a science-based perspective.

(1) Institutional Long-range Goals.

In recent years the public has become increasingly sensitized to the potential risks posed by food and waterborne diseases, chemicals in food and the environment, and the uncertainties surrounding the safety of new technologies and innovations. Land Grant universities such as Iowa State University have recognized a particular challenge in addressing risk-based concerns relating to food and feed production and the safety of the foods we consume.

As a leading Land Grant university, ISU is at the forefront of efforts to assure the safety and integrity of the US food supply. ISU has focused on developing expertise in risk analysis – the science-based assessment of risk, its management, and communication – as a means to both address public concerns and policy regarding the safety and integrity of the food supply. The Provost's Office has sponsored new tenure-track faculty positions in risk assessment that have been filled within the Colleges of Agriculture and Veterinary Medicine. Recruitment efforts are underway to hire a faculty member in risk communication within the Greenlee School of Journalism and Communication.

A specific focus in ISU's strategic hiring in the area of risk analysis and communication is to strengthen the quality of educational opportunities relating to understanding and analyzing risk. The strategic plan of ISU's College of Agriculture (<http://www.ag.iastate.edu/news/coafinalsp.pdf>) highlights as key long-range objectives the need to address consumer concerns regarding the safety and security of the food supply as well as the need to establish links between food quality and human health and nutrition. In order to “help Iowans produce and consume safe, nutritious foods, the

College of Agriculture, in partnership with the Colleges of Human Sciences, Veterinary Medicine and Liberal Arts and Sciences, is responding by addressing key themes that relate to student learning focused on [the] assessment of risks to the food supply and [the] protection of our citizens against agricultural bioterrorism.” A leading goal specified in the College of Agriculture’s strategic plan has been is to provide students with new educational experiences in food safety, risk assessment and related issues. As a parallel goal, the same strategic plan highlights the need to integrate policy-related research into the classroom. The College plans to meet these identified goals by (a) establishing a multi-disciplinary graduate minor in risk assessment focused on food safety as well as plant and animal production; (b) developing educational experiences in food safety and risk assessment open to all students; and (c) increasing the number of graduate courses that integrate policy issues and policy-based research information into educational materials. Success in reaching these goals is being measured by the credit hours of courses related to food safety/risk assessment courses that are offered and the number of other educational experiences in food safety/risk assessment and public policy that the College provides.

These goals and strategies are well represented beyond the College of Agriculture and throughout ISU. These goals and the strategies to achieve them resonate with the strategic plans of other units across campus. For example, the College of Veterinary Medicine considers population-based and evidence-based medicine as lead elements in new curriculum development. Risk-based training is recognized as a component of these elements. In addressing its priority of strengthening undergraduate, graduate, and professional education to enhance student success (<http://www.iastate.edu/~strategicplan/>), ISU has actively increased institutional support for activities relating to risk analysis as evidenced in the recent hiring of two faculty members specializing in risk assessment in food, agriculture, and veterinary medicine and the planned search for a tenure-track position in risk communication. This new position is in accord with the College of Liberal Arts and Sciences’ stated goal of encouraging and supporting the development of collaborative teaching and interdisciplinary courses as well as cross-disciplinary research and creative activity. The College’s expanded engagement mission encourages students and faculty involvement in addressing the social, political, ethical, and economic challenges and opportunities facing the state (<http://www.las.iastate.edu/main/strategicplan.shtml>). The ISU Institute for Food Safety and Security (IFSS) has been structured as an umbrella organization to coordinate these diverse research, education, and outreach components campus-wide (<http://www.ifss.iastate.edu/about/>). IFSS has identified the development of risk analysis training opportunities as a lead objective.

(2) Identification of Educational Problem and Project Impact.

Our proposal lays the foundation for the identification, modification, and where necessary, development of courses to fulfill a graduate minor in RA&DM. We anticipate the audience for the minor/certificate will be interdisciplinary and at the master’s degree-level. However, some courses offerings will be of interest to baccalaureate degree-level and first professional degree-level veterinary medicine (DVM) students. In keeping with

the nature of RA&DM, most new offerings will be team-taught by affiliated faculty and will be targeted to the general student population in addition to its being offered as a minor area of study.

Developing educational opportunities for understanding and addressing risk cuts broadly across the Priority and Educational Need Areas identified in the USDA-HEC FY 2006 grants solicitation. We focus in this proposal on Priority Area #2 and specifically on Strategic Goal #3 to address the enhanced protection and safety of the nation's agriculture. Our proposal entails the development of coursework and attendant sub-elements for a graduate certificate and interdisciplinary minor. Our products are therefore intended to be used in both on-campus and distance learning venues. This effort provides a means whereby, based on knowledge and education, we can train professionals to reduce the incidence of food borne illnesses and contaminants (Objective #3.1). In addition, we propose to develop and deliver science-based information that allows for a better understanding of the number and severity of agricultural pest and disease outbreaks (Objective #3.2). Our current and proposed efforts will facilitate the development and delivery of for-credit, academic coursework that prepares graduates to specifically address national issues relating to animal and plant biosecurity and the development and deployment of new bio-based products and technologies.

ISU's newly re-organized Institute for Food Safety and Security (IFSS) is involved in on-going stakeholder discussions among food production, processing, and distribution enterprises within Iowa. A recurring theme is the need for training addressing science-based risk assessment and effective risk management and communication strategies. One element of our proposal is to formally identify this client base and to benchmark our proposed curricula design for a graduate certificate to employer needs. We will additionally report outcomes of our programmatic changes and their early implementation in order to refine and match our products with the expectations of our client base.

Our proposal specifically addresses Educational Need Area 1: Curricula Design and Materials Development. This proposal entails developing new (or adapting existing) curricula and related materials that facilitate a graduate minor in Risk Assessment and Decision-Making (RA&DM) to meet changes anticipated within the domestic or international food and agricultural sciences system. These new and adapted curricula will be leveraged well beyond the RA&DM minor as certain coursework will be adopted within other major and minor areas across ISU. Additionally, select curricula will be used for distance delivery to meet the needs of off-campus clients for degrees, training certificates, or continuing education credits. Our lead course offering, *Risk Analysis for Food and Feed Production*, is targeted as an upper undergraduate offering which will provide an overview of risk analysis as applied to issues in food and agriculture and is anticipated to garner broad student interest and participation.

Our proposal also extends to Education Need Area #2. We consider the multidisciplinary faculty associated with this proposal a key strength. A current relevant offering AGRON/VDPAM/TOX 570X, *Risk Assessment for Food, Agriculture and Veterinary*

Medicine is taught by faculty in the department of Agronomy and Veterinary Diagnostic and Production Animal Medicine and exemplifies the multi-disciplinary teaching approach that will be an integral element of further course development (appendix). This multidisciplinary approach to course content is essential to ensuring students are able to apply the concepts across multiple areas, to capture the breadth of RA&DM, and to avoid duplication of course offerings across the campus. To solidify this approach and to make course appealing to a wider campus audience, the proposed new courses, *Science Policy Formulation and Risk Analysis for Food and Feed Production* will also have multi-disciplinary approach from the point of curriculum development. However, given the traditional format of department based course offerings, few faculty are familiar with the formation of policy or utilization of risk analysis outside their area of expertise; therefore, we are requesting funds for the faculty members involved in the development of those courses to meet and train with scientists and government personnel in policy units nationally and internationally. Furthermore, we are also requesting funds for training in methods of material delivery to ensure the faculty revising courses are aware of and able to incorporate technologies that will enhance students' understanding and application of RA&DM core concepts.

We anticipate high impact for improving the quality of food and agricultural sciences education through the establishment of the graduate minor in RA&DM. The idea of such training clearly resonates with the university community and our efforts to date in establishing a lead course in risk assessment have engendered considerable interest (<http://www.ag.iastate.edu/aginfo/news/2005releases/agrorisk.html>). In addition, the enthusiasm generated by the course offerings has been high. The experimental offering of 570X (*Risk Assessment for Food, Agriculture, and Veterinary Medicine*) attracted a total of 13 graduate students from seven departments representing four colleges. Student evaluations gave above average marks for the quality and nature of information presented. The course VDPAM 522 (*Principles of Epidemiology*), which is being adapted to RA&DM, has been offered since 2000 and has trained students from six departments and three colleges.

(3) Project Justification.

Specific instructional problem or opportunity to be addressed. Students are bombarded with information both within and outside the confines of their formal education that invokes the terms “risk” and “safety.” Because these terms are value-laden, students are largely unaware that issues of risk and safety can be addressed from a consequence-based perspective using the formal tools and approaches of risk analysis. For instance, little is also known about the extent to which information sources regarding risks are successful when trying to effectively convey the complexities, ambiguities, and controversies that surround issues of food safety. As a result, in the area of food safety, effective public involvement has been hindered by inadequate information, indecipherable messages, and the limited skills of citizens in evaluating conflicting information. There is, therefore, a *critical need* to evaluate the relative effectiveness with which scientifically-based risk information is being communicated to individuals; and the extent to which that information is integrated with other relevant information from government and industry

communication programs. There is also a need to determine how that information influences citizens' perceptions and attitudes about food safety.

In particular, students' training for scientific careers should instill the need for their science-based knowledge to be appropriately valued and mirrored in public policy decisions. Students are largely unaware, however, how risk analysis can be used to connect science with public policy through the assessment, management and communication of risk. Providing formalized instruction in the overall process of risk analysis can contribute to better communication and use of scientific information. A graduate certificate or minor offering in RA&DM will particularly benefit students in science-based disciplines who pursue non-research careers in education, industry, government, or non-governmental organizations.

How and by whom the focus and scope of the project were determined. The motivation for this project originated from multi-party stakeholder input, which led to ISU's College of Agriculture Strategic Plan. Ongoing discussions by interested faculty, administrators, and external advisors at ISU along these lines are facilitated through the IFSS and its affiliate, the Biosafety Institute Genetically Modified Agricultural Products (BIGMAP). Both of these centers are the outgrowth of the College of Agriculture Strategic Plan, and both identify risk and policy analysis research and education as key needs for addressing public questions regarding the safety of our nation's food supply. The specific focus and scope of the current project was developed by the project directors in concert with interested faculty throughout the university and in consultation with lead administrators and center directors (appendix). Our proposed focus and scope are consistent with existing ISU guidance for the development and approval of graduate minors.

Body of knowledge justifying the need for the proposed project. As discussed by Jenkins (1999), science education is frequently reflexive in that it acquaints students to science as a "formal, algorithmic, and ritualistic" activity (e.g., the scientific method). More advanced training of graduate students within scientific disciplines goes well beyond this, but it is to this baseline tenet of science where students should retreat when first encountering a new technical problem. Jenkins further recognizes that "risk lies at the heart of many science-related policy issues" and the various means of reconciling the ways in which risk is estimated are not easily discerned from the reflexive attention to the minutiae of physics, biology, or chemistry. Rather, risk-based decisions delve into considerations of issues that are less clearly scientifically discerned and which are controversial.

In attempting to deal objectively with issues of risk, the risk analyst invokes the formalized science-like process of risk assessment (NRC, 1994) and its integration though an analytical-deliberative process into societal decisions (NRC, 1996). As described by Morgan and Henrion (1990), quantitatively based risk and policy analysis cannot fully adhere to the strictures of science in terms of empiricism, documentation, measurement of heterogeneities, peer review, and open debate. This is disconcerting and disturbing to the scientist, especially when the risk analyst willingly accepts and addresses unknowns (lack- of- knowledge) (Morgan and Henrion, 1990). In order for

science to effectively impact public policy decision-making, the scientist must understand the strengths and limitations of risk assessment as a bridging element between science and its integration with other facets of decision-making. Our objective is to provide graduate students with the understanding of the risk assessment, management, and communication elements of risk analysis so that they can better understand how science can impact decisions.

Project value to Iowa, the Midwest, national, and international training. The philosophy of science-based risk assessment underpins regulatory action within the United States where risk analysis is the accepted approach for decision-making in health, safety, and environmental policy. The ability for science-based risk assessments to be integrated into policy decisions using the comprehensive tools of risk analysis is recognized as critical not only to national agricultural policy (see for instance, USDA's Office of Risk Assessment and Cost-Benefit Analysis, <http://www.usda.gov/agency/oce/oracba/about.htm>) but has important ramifications to international agricultural trade. Every agricultural regulation and policy has ramifications to the supply, demand, and price of agricultural products emanating from the US heartland. Located in the heart of one of the world's most intensive food-producing areas, Iowa State University is uniquely positioned to set the stage for risk analysis and decision-making certification and minor programs. As we outlined under "Institutional and Long-Range Goals," ISU is poised to be the banner university for studying food safety and security. The programs we propose support the university's intent to become an outreach and communication hub addressing food safety risks. The university-wide effort to "develop research and training programs that engage in human health risks and issues that arise from globalization, intensification of agricultural production, food processing, global warming/environmental changes and the prevention of agricultural bio-terrorism" are objectives that are germane not only to Iowa and the Midwest, but are relevant to national and global interests as well.

The need for and importance of a broader understanding and use of science-based risk analysis is a recurring theme in the comments and suggestions of various stakeholder groups whose inputs are solicited in the design of ISU's long-term strategic plan. The value of our proposal can also be gauged by stakeholder support in terms of grants, endowments, and collaborative activities. We currently have support to develop distance education training materials through the College of Agriculture's Brenton Center for Agriculture and Technology Transfer and through a federal appropriation administered through the USDA-APHIS-BRS. Further support from external sources is forthcoming.

Related ongoing or recently completed significant activities receiving previous HEC funding. No HEC funds have yet been expended in support of the RA&DM program.

(4) Innovation.

Approach to improving the quality of food and agricultural sciences education. The continuing shift of the United States from a rural to an urban and suburban population is distancing most citizens from their rural roots. The decline in the percent of US

population involved in agriculture and in food production and processing has resulted in less public knowledge and, subsequently, skepticism regarding the safety of food and other agricultural products. Scientists, in order to successfully advance innovation within food and agriculture, must be better equipped to understand, assess, and communicate the risk and benefits of the modern agricultural enterprise to this increasingly skeptical public. Risk analysis is an established, science-based means to address the need in terms of effective assessment, management, and communication of risks and uncertainties. Our proposed training in research methodologies, risk analysis methods, risk interpretation, risk communication, and the decision-making process will begin to provide instructional tools that can improve food and agricultural sciences education by showing the means whereby scientific knowledge can be reflected in decision making. To our knowledge, a broadly integrative, multidisciplinary, agriculture-focused graduate certificate/minor in risk analysis is a unique undertaking.

(5) Multidisciplinary Focus.

Relevance to multiple disciplines in food and agricultural sciences, and with other academic curricula. In initiating strategic thrusts targeted to building risk analysis capacity at ISU, it has been the view of administrators that risk analysis and decision-making concepts should be established in programs across the campus, rather than as an isolated enterprise within the university. This is demonstrated in recent hiring decisions which have/will bolster faculty devoted to risk analysis throughout the campus. Initial hires have been made in the Colleges of Agriculture and Veterinary Medicine, and a third faculty member specializing in the communication of science and risk will join the Greenlee School of Journalism and Communication under the College of Liberal Arts and Sciences. This combination of specializations is prudent since risk analysis is an integrative activity that requires multi-disciplinary expertise.

This multidisciplinary focus is very much reflected in the development of RA&DM graduate certificate and minor programs. The spectrum of offerings, the syllabus of many of these offerings, and the administrative approach to the envisioned certificate and minor programs will all emphasize a multidisciplinary mindset.

This multidisciplinary ethos is exemplified in our initial offering in support of the minor. *Risk Assessment for Food, Agriculture, and Veterinary Medicine* is cross-listed in Veterinary Diagnostics and Production Animal Medicine (VDPAM), Agronomy (AGRON), and Toxicology (TOX). This course is also intended to be listed within the Food Safety graduate minor and in the interdepartmental Environmental Science program. The design of this course assumes cross-disciplinary enrollment and uses a team approach in presentations and student projects to introduce the multidisciplinary nature of risk analysis. We anticipate that existing courses incorporated into the graduate minor will be modified in ways that increase the disciplinary mix within the courses. Two courses we intend to develop will be co-designed and co-taught by faculty affiliated with the minor with the intent of developing a clearly multi-disciplinary view of the risk analysis process (see, *Risk Analysis for Food and Feed Production and Science Policy Formulation* under plan of operation and the Framework Proposal, appendices).

Governance of the RA&DM graduate minor will be multidisciplinary as well. This is in keeping with the nature of the minor and the university policy for graduate minors. The breadth of the multidisciplinary scope is reflected in our graduate minor planning team that involves 16 faculty members representing 13 departments/programs, and in five colleges.

Project adaptation as a model for other institutions. We believe the RA&DM minor and, in particular, the specific course content being developed for the minor can be extended to similar projects and ventures at other Land Grant institutions. We are exploring opportunities to do so through our involvement (Wolt) with related national activities that seek to develop and disseminate multidisciplinary courses to participating institutions. One such model that serves this purpose is the NSF-funded LANGURE project (<http://www.chass.ncsu.edu/ethics/langure/>) that is developing graduate coursework centered on research ethics – one element being the use of risk assessment in decision-making. We are also engaged in planning activities supported by Information Systems for Biotechnology (Wolt) to develop training modules for teaching biotechnology risk assessment.

(B) Proposed Approach and Cooperative Linkages:

(1) Objectives.

The overall goal of this proposal is to develop and adapt curricula and related materials that will lay the foundation for the establishment of graduate certification and a graduate minor in Risk Analysis and Decision-Making (RA&DM) at Iowa State University. We consider the graduate certificate and graduate minor to be complementary opportunities addressing the educational and training needs of two major groups of clients—registered graduate students on campus for the minor and off-campus continuing learners for the certificate. Both programs have similar requirements in terms of core course development and governance. Specifically, this proposal aims to:

- (i) *Design and introduce new course offerings in risk analysis and decision making.*
- (ii) *Identify, evaluate and revise the syllabi of relevant existing course offerings to embed RA&DM core concepts.*
- (iii) *Adapt risk analysis course offerings for distance delivery and targeted client-or audience needs.*
- (iv) *Develop the administrative and governance infrastructure for the envisioned multidisciplinary certification and minor programs.*

(2) Plan of Operation and Methodology.

- (i) *Design and introduce new course offerings in risk analysis and decision making.*

Three new courses are envisioned to constitute the backbone of the RA&DM graduate minor. A co-PD will be responsible for each of these courses by (a) identifying the instructor(s), (b) providing leadership in syllabus development, (c) overseeing the course through the college and university approval process, (d) coordinating the integration of course content with other RA&DM offerings, and (e) gaining approval as an experimental offering. Each of the courses we proposed will be designed, approved, and offered as experimental courses within the term of this project. (Full integration into the university register of classes is a more prolonged process outside of the term of this proposal.) These three flagship courses are:

- a. *Risk Analysis for Food and Feed Production.* (3 credits) The course will provide an overview of all facets of risk analysis (assessment, management, communication, perception) and the use of risk analysis in policy formulation. Lead PDs, Scott Hurd & Jeff Wolt. This course will be team-taught by affiliated RA&DM faculty and will be an upper-undergraduate listing targeted to the general student population and as an offering to RA&DM minors. Development of this course will require identification of core faculty for the planning and delivery. A planning and delivery team (Hurd, Wolt and Jensen) will assure widespread input from the university community and integration with collateral program development elsewhere on campus. Jensen, for instance, is developing a policy analysis module for a new joint program in nutrition and will assure that the Risk Analysis for Food and Feed Production offering meets collateral needs of this offering.
- b. *Risk Perception and Communication for Scientists.* (3 credits) This course is expected to inform scientists of ways by which they can become active contributors to the public understanding and knowledge of risks, and how they can help cultivate a public informed enough to make wise and respectful choices about issues with critical scientific and ethical underpinnings. Lead PD, Lulu Rodriguez. Communication is an integral factor in disseminating, sharing, and keeping different segments of society aware of the benefits and risks engendered by scientific and technological breakthroughs. More importantly, it offers the most potent mechanism by which a multiplicity of voices could be heard in the process of shaping policy decisions about the trajectories the scientific and technological communities should take. The course aims to assist in making scientists more conscious of how audience receptivity to often complicated risk topics could be enhanced. Scientists can also provide valuable guidelines to journalists on how best to deal with the barrage of scientific claims and counterclaims engendered by complex food safety issues, so that scientific information could be interpreted to make them relevant and comprehensible to audience groups.

Science Policy Formulation. (3 credits) This course will focus on how policy makers interpret and translate information from experimental

reports, complex observational studies, mathematical models, systemic reviews, meta-analysis, expert deliberations, and risk assessments. Lead PD, Annette O'Connor. We anticipate using several well developed case studies that illustrate key concepts in translation of scientific information into policy, as well as several guest speakers. For example, as an illustration of the importance of incorporation and understanding of uncertainty into policy, the use of mathematical models applied in the UK 2001 Foot and Mouth Outbreak will be used (Taylor, 2003). This example is within the lead faculty member's area of expertise and funding will be used to develop similar examples from other disciplines such a microbial food safety (BSE, E coli), antibiotic resistance, pesticide use, GMO adoption, and animal welfare. The course will also incorporate units of study on the differences in approach to policy formation internationally. It is currently anticipated that this unit will focus on either GMO or antimicrobial growth promoters. In order that the course realistically reflects the interplay of science and policy, on-campus collaborators (Carrquiry and Jensen) with policy expertise will be engaged in course design as will consultation with national and international policy planners.

- (ii) *Identify, evaluate and revise the syllabi of lead course offerings to embed for RA&DM core concepts.* Lead PD, Scott Hurd. This objective will address needs assessment for core offerings and embedding of RA&DM concepts within core courses. Many courses currently offered at ISU contribute key elements essential to the process of risk analysis (see for instance our initial concept document, appendix). Multiple interactive seminars will be conducted in targeted departments and programs to introduce our program intent and elicit broader faculty involvement. This, in conjunction with administrative input, will allow us to expand our existing ad hoc network of interested faculty. This expanded group will allow us to develop core concepts for communicating RA&DM and identify appropriate existing courses that can serve as the core for advancing these concepts. The project leadership will then involve these instructors in course revision by developing and supplying them with the core concepts for incorporation in revised syllabi.
- (iii) *Adapt risk analysis offerings for distance delivery and targeted client or audience needs.* Lead PDs, Wolt and Hurd. A graduate certificate will be of greatest value to continuing learners already in established careers for whom distance learning can satisfy career growth needs. Therefore, we view the distance delivery of RA&DM courses as necessary for a successful certification program. We are currently supported through internal funds (ISU's Brenton Center for Agricultural Instruction & and Technology Transfer) and external monies (federal funds earmarked for BIGMAP) to develop risk assessment coursework for distance delivery. A portion of this effort adapts existing instructional materials into client-specific learning modules for delivery in off-campus degree programs, continuing education workshops, and certification programs. This approach will be continued with

the instructional materials developed as part of the RA&DM certificate program. A formative evaluation of our potential client base in the food and agricultural enterprises will be conducted to gauge their needs, which will then inform course content.

- (iv) *Develop the administrative and governance infrastructure and governance for the envisioned multidisciplinary certification and minor programs.* Lead, Wolt. Proposals for either a certificate or a minor program require an infrastructure for administration and governance in order to gain approval by the Graduate College. As we have described, ISU’s umbrella institute for food safety, IFSS, has identified risk analysis training as a lead objective. In accordance with its mandate and stated objective, IFSS is proposed as the administrative home for the RA&DM programs. We will work with an ad hoc group of interested core faculty and the ISU deans to formulate governance policies and to identify the programs’ administrative requirements.

Procedures for accomplishing the project objectives. We have already laid the groundwork in developing our training thrust in RA&DM. Initial consultations with faculty members and administrators throughout the university community have led to the identification and design of our initial course offering, the allocation of seed monies to begin distance delivery module development, and conceptualizing the broader programs we propose. If funded, this proposal will allow us to move to the formal stages of designing relevant curricula; pilot-testing the new courses; embedding key RA&DM concepts within the syllabi of existing courses identified as core to RA&DM; and, establishing the governance structure and means to administer the certification and minor programs. Lead PDs have been identified to spearhead each objective. This proposal is intended to support this foundation-building phase. The outcomes of our initial efforts will be evaluated by independent teaching and learning experts.

Management of the project to ensure its proper and efficient administration. resources and personnel used to conduct the project. IFSS has been provisionally identified as the administrative home for efforts to launch the RA&DM certificate and minor programs. Two of the project PDs (Wolt and Hurd) are affiliated with IFSS and will be responsible for the overall management of the proposed work. IFSS has administrative resources and personnel in place to allow for the efficient administration of this stage of our activity with minimum cost to the project.

(3) Timetable.

Months	Timing	Objectives	Activities
0 - 6	Fall 06	2	review existing courses relevant to RA&DM; engage in discussion with faculty re course revisions
		2,4	initiate design of RA&DM core concepts
		1	assemble planning teams for new course development
		3	complete distance delivery modules for 570X (already initiated)
		1	new course design
		1	external consultations on new course design

		4	first draft governance/administration plan
6 - 12	Spring 07	1,2,4	introduce RA&DM campus-wide presentations/consultations
		2,4	workshop for delivery of RA&DM core concepts to faculty who will be undertaking course revisions
		1	new course design
		3	distance offering of 570X
		3	continuation of distance delivery development
		3,4	stakeholder needs assessment: RA&DM certificate
		2	targeted course revisions
		1,2	initiate approvals as needed for new and revised courses
		4	revised governance/administration plan
12 - 18	Fall 07	1,2	campus-wide communication of initial course offerings
		1,2	continuation/completion of revision and new course development
		1,2	continuation of approvals for new/revised courses
		4	campus-wide updates, elicitation of feedback/refinements
		3	continuation of distance delivery development
18 - 24	Spring 08	1,2	roll-out of initial new and revised course offerings
		3,4	solicitation of client feedback on certificate development
		1,2,3,4	data gathering and evaluation
		1,2,3,4	reporting/manuscript preparation
		4	continuance planning
		3	continuation of distance delivery development

(4) Products, Results and Measurable Outcomes.

Expected products and results, and their potential impact.

- *Objective i)* New course development will result in the sequential delivery of the following products: syllabi, experimental course approvals, and initial course offerings. This will result in new student learning opportunities in RA&DM and will be measured as the number of student contact hours these courses generate (over the current baseline of 0). [Student contact hours are the number of hours offered per week multiplied by the number of students enrolled in the courses.]
- *Objective ii)* Course revisions to meet the needs for appropriate RA&DM core content will result in syllabi revised and reconfigured to project more RA&DM content. This will result in greater student exposure to RA&DM core concepts. Potential impact will be measured in terms of the number of hours students were introduced to and trained about RA&DM core concepts over the current baseline of 39 hours (representing the student contact hours for the initial offering of 570X).
- *Objective iii)* This objective aims to produce RA&DM course and training modules meant for distance offerings. The result is increased opportunities for off-campus learners to become exposed to RA&DM core concepts. We will measure potential impact as the number of distance-learning contact hours for courses or training modules delivering RA&DM core concepts (over the current baseline of 9 hours representing the contact hours for the initial distance offering of 570X).

- *Objective iv*) This objective will generate governance documents that detail the mechanism for administration of the graduate certificate and minor programs for RA&DM. These products (in conjunction with core coursework) will enable the offering of new programs by identifying the mechanisms and resources. Because full approval for the envisioned programs will run beyond the term of this project, the intermediate measurement for this objective is the completed governance documents for review by our program evaluator(s).

(5) Evaluation Plans.

In order to assure objectivity in the evaluation of program success (products, results, and impact), we will use a professional evaluator (Correia) for assessment of project educational accomplishments. Evaluation activities will consist of measuring the degree to which stated objectives are met, the quality and cohesiveness of the new and revised courses to the sustainability of the graduate certification and minor in RA&DM, and the overall effectiveness of the core curricula. An assessment of the governance documents in supporting a multidisciplinary program will also be required. Standardized student evaluation of new or revised courses as well as elicitation of external commentary by the evaluator will be used to study the project's impact on improving education in food, agriculture and veterinary medicine.

(6) Dissemination Plans.

As is customary at Iowa State, newly developed and revised courses will have websites featuring descriptions, syllabi, teaching resources and other course materials. Training materials that deal with risk assessment core concepts, governance and administrative system documents, and approvals for the certificate and minor programs will be posted in a website dedicated to RA&DM.

Through involvement in ISB and LANGURE projects in curriculum development, we have additional means for communication of project outcomes. Integration of the ISU program into a multiregional curriculum is a long-term goal that is not addressed in the current proposal.

We seek to publish our curriculum development experiences in outlets intended to highlight scholarship in teaching, such as the *Journal of Natural Resources and Life Sciences Education* and the *Journalism and Mass Communication Educator*. These conduits will serve to apprise and assist fellow educators faced with the challenge of incorporating risk analysis concepts in courses across disciplines within institutions concerned with food, agriculture, and veterinary medicine.

(7) Partnerships and Collaborative Efforts.

The co-PDs and senior associates on of this proposal represent six departments and four colleges in the university. Our initial activities toward the launching of the proposed certificate and minor in RA&DM have included soliciting the advise of faculty members from 13 departments, three interdepartmental majors, and five colleges across campus. Such broad multidisciplinary input is in keeping with the nature and extent of the risk analysis enterprise and is critical to our success. This extensive collaboration serves to

focus diverse faculty expertise on a concern of great importance to food and agricultural enterprises, citizens, and consumers.

The certificate program we envision via distance learning also represents our response to the challenge posed by the private sector for more enhanced and relevant food and agricultural sciences education.